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A great many of the engine houses on American railways were, up to a few years ago, poorly built, poorly equipped, and in general, places calculated to make the effective repairing of locomotives as difficult as possible. There has been a great improvement in these conditions within recent years, but there has not been a corresponding improvement in car repair yards. The old idea that the worst place in the yard will do for the "rip" tracks still holds in many places. We have in mind one case in particular in which the terminal has a new and modernly equipped engine house, while the car repair tracks are in a most inconvenient location, with the space between them not leveled off or planked, and the material stores a full half mile away. Such conditions as these prevent the prompt repairing of cars, cause friction between the mechanical and the operating departments, and increase expenses.

Provide Good Car Repair Facilities

The individual paper on Impact Between Freight Cars in Switching Service, by Prof. L. E. Endsley, proved of very considerable interest to the convention and brought out a lively discussion. There seems, however, to be quite a little difference of opinion concerning the amount of such shocks, and judging from this and the curves presented in the paper, it would seem desirable to go further into the matter. It hardly seems possible that the enormous shocks indicated could be absorbed by present-day car construction; in fact, if such shocks were very frequent in service it would seem that there must be a great increase in the number of disabled cars. The investigation, however, is of extreme interest, and bearing so directly on the matter of efficient draft gear, the association acted wisely in referring the matter to a committee for further investigation.

Impact Between Freight Cars

The proposition of providing a joint car repair shop at large terminals for the purpose of making repairs to foreign equipment coming into these terminals, is a question of importance. The General Superintendent's Association, of Chicago, is now seriously considering a proposition of this kind. The establishment of a joint shop in the switching district of Chicago, located at the Stock Yards, is the plan it has in mind. By this means it will be possible to take defective cars coming into this district and repair them, making them available for loads. The switching of defective cars to the lines from which they were received will be eliminated, with the corresponding expense and a reduction in congestion of the switching lines. It has been estimated that 250 cars per day would need such repairs at the joint shops in Chicago, these to include both light and heavy repairs. Such shops would also increase the available car supply in the congested districts, thereby saving considerable money both in intermediate charges and per diem which accumulates while such cars are being moved back and forth.

Joint Car Repair Shops

The M. C. B. Committee on Brake Shoe and Brake Beam Equipment has twice submitted to the association a recommendation for a standard No. 2 brake beam which it considered satisfactory for adoption as recommended practice. On both occasions the association refused to adopt the committee's recommendations, but, as stated on the floor of the convention on Monday, the committee was unable to obtain from those who objected to the beam any specific reasons for their action or any definite information which would help them in deciding on a design which would meet with general approval. Whatever the reasons for such action, it can scarcely be termed creditable to the association. If the members were not in agreement with the action of the committee they should have at least stated their reasons, giving the committee something to go on in continuing its work. As no specific information was obtainable after the recommendations had beeen rejected, there was, of course, nothing left for the committee to do but drop the matter; but this year the discussion in the convention brought out clearly that the brake beam as recommended previously by the committee is desirable.

The No. 2 Brake Beam

In the report of the Committee on Car Construction it was recommended that the draft attachments, including the draft arms, if used, must be of metal, of either integral or riveted construction. S. G. Thomson, in explaining this, said that it was placed in the report to get rid of the old wooden draft arms which are causing so much of the trouble with the draft gear. The committee has considered the advisability of requiring the removal of all wooden draft arms from cars in interchange service by a certain date. It was decided, however, not to take any definite step at present, but the members would do well to carry out Mr. Thomson's suggestion. Wooden draft arms are a source of great trouble; the sooner they are dispensed with the better. Railways should take it upon themselves to remove them just as quickly as possible so

Wooden Draft Arms

that if a date is finally set in which cars so equipped will not be received in interchange service, the number of cars left to be changed will not be so large that a remote date will be necessary. The members of the association have here an opportunity to be of great service to the railways in general without the compelling force of any association requirement.

Developing Car Foremen

Because of the large amount of work that is done piecework in the car department, and the employment in such work of unskilled and illiterate laborers, this department has suffered beyond some of the other branches of railway work. It is a trying problem under such conditions to obtain the right class of men for development into inspectors and foremen. The requirements of interchange make it necessary that car department officers be of a studious nature and capable of handling the large number of reports and statements which originate in such work. This requires men of more than ordinary intelligence and it is seldom that they can be procured or developed from the class of labor that is commonly employed in making car repairs. The position of car inspector is the most natural one from which to select a man to advance to the position of foreman, as an inspector must be thoroughly familiar with car repairs. It will, therefore, be necessary to develop some means of training men along these lines for later promotion to the minor official positions. An efficient apprenticeship system would seem to be the most logical means of accomplishing this and great care should then be taken in selecting the men for promotion to see that those chosen show promise of the proper qualifications.

SCIENTIFIC SELECTION OF MEN

WE commented in *The Daily* of June 9th on Professor Herman Schneider's paper before the National Association of Corporation Schools on the selection of men for given jobs. Long study, based on practical observations of an exceptional nature, has forced Professor Schneider to the conclusion that the only way of successfully selecting a man is by actual practical trial on the job. If the man fails, the reasons for the failure should make it possible to transfer him with some degree of assurance to a class of work for which he is better fitted. Assume for a moment, however, that Professor Schneider is wrong and that it is possible scientifically to select men by other means that require a less tedious and shorter examination or observation. What good would it do if the organization was such as not to make scientific use of the men after they were selected? How many organizations are now operated on such a basis that the officers know with any degree of accuracy whether they are getting the best efficiency from the men as individuals, or the organization as a whole? How many railway officers really know whether they are getting 50, 75 or 90 per cent efficiency from the department under their direction, whether it be a repair shop, a car repair yard, an engine terminal, or an office?

Instances are not by any means unusual where investigation has developed the fact that a department was working at 50 or 60 per cent efficiency. Better supervision, improved facilities, etc., may have been introduced which brought it up to 90 or 95 per cent efficiency. The point which we wish to make is that employers are not by any means making the best use of the men that they have, and until this is better understood there is little or no use of going to extremes in trying scientifically to select men. It is true that there may be certain highly specialized jobs which require men of a special type, but such jobs are comparatively few. On average jobs the average men available will do about as well in one class of work as another, within reasonable limits.

Our friends in certain of the European railway shops, realizing the necessity of trying the men out in a practical way, are handling this matter in a way which we can well afford to study with a view to improving our own practices. They study the apprentices while they are in training and find out just what classes of work they make the best records on and seem best adapted to. At the end of their apprenticeship they are assigned to certain departments on the basis of this data, which is a matter of record. For instance, if they are of what may be designated the mental type, there is little use of assigning them to manual work. A man with a highly nervous disposition will make a success of certain classes of work in the machine or erecting shop, but will have an extremely low efficiency on work which requires a steady plodder. Certain types of work require initiative; others do not call for this characteristic and can be filled by men who are good on routine work but helpless when it comes to developing new plans or methods.

It would seem that under present conditions we are not warranted in going much farther into the scientific selection and assignment of men than is done on these foreign roads. There is a field, however, which offers great possibilities, but which thus far has not been worked to any great extent by either our railroad or industrial managers; this is, that of more critical and logical study of the performance and possibilities of the men already in the service, and this study should extend from the very top to the bottom of the organization. No man should ever be promoted in a haphazard manner. Records should be available, and these can be easily kept and at a very low expense, showing in a rough but fairly accurate manner whether a man is good or bad in respect to those traits which affect his work and fit or unfit him for executive positions. When the time comes for promotion, it is not safe to look a man over and promote him on the basis of the impressions of the moment as to his fitness for the job, but simple records should be available as to his work and personality which will check this decision. These records should be revised from time to time so that the supervising officer will know whether a man is improving or not, and whether his immediate superior officer is developing him along proper lines. Such a system has been tried out with good practical results, and was fully described in the *American Engineer* of November, 1908.

If you do not have such records, why not? It is a comparatively easy and simple matter to install and maintain them, and the expense is practically negligible. The trouble is not so much to know how to do the thing as to get people to realize the necessity of so doing, or in other words, to wake them up to a matter of vital importance which is not now as generally appreciated as it should be. Until those in charge make every effort to study and analyze their men in this way, in order to get the maximum individual and collective efficiency from them, there is little use in wasting time in going to extremes in selecting the raw material which is taken into the organization at the bottom; and, moreover, if Professor Schneider's conclusion is correct, and the data which he presents leaves very little question as to its correctness, it is folly to try to find a shorter and less tedious method of selecting men than that of trying them out under actual working conditions. The essential thing is to first establish a management sufficiently scientific to make the best use of scientifically selected men, and this applies to shopmen or car repairmen selected for the greatest output; car inspectors selected for their ability and speed in doing their work, or engineers selected for reliability.

In addition, the railroads can well afford to establish employment bureaus to select the men along broad lines, looking into their records and making such examinations or inquiries as to insure the selection of clean, strong, capable men. Such a bureau should also look into the conditions of employment and questions connected therewith, but little more than this can be done under present conditions so far as the scientific selection is concerned.

Master Car Builders' Association Proceedings

Reports on Train Lighting; Car Trucks, and Draft Gear; Papers on Value of a Patent and Impact of Cars in Switching

President Crawford called the meeting to order Wednesday morning at 10 o'clock.

[The following individual paper was presented at the Tuesday meeting, but was not included in the yesterday's *Daily*.—EDITOR.]

WHAT IS THE VALUE OF A PATENT?

BY PAUL SYNNESTVEDT

That the value of a patent is often the subject of a wide divergence of opinion may be well illustrated by an incident which came to my notice a short while ago. In the case in question—which related to a refrigerator car structure—there had been an accounting ordered, after a finding of infringement, and the master appointed to take testimony on the accounting had handed in a report recommending a recovery totaling $663,000. This recommendation had come up for action before one of the district judges in the United States Court, who had come to the conclusion that, under the law as announced in the authorities, the right to recovery had not been established, and that, therefore, he could award only what is called "nominal damage," the amount being fixed at 6 cents.

When it is taken into account that in connection with the incident just related the master was acting on his understanding of facts formally made of record, and the widely variant conclusion of the judge was rendered by one of our most highly respected authorities on the same facts, it is clear that to fix the value of any given patent in an exact amount of dollars and cents is a very difficult thing to do. On the other hand, it can, I think, be fully maintained that there are elements bearing upon such a question which as to the principle involved may be clearly established.

VALUE OF A PATENT TO THE GENERAL PUBLIC

A patent is a benefit to the public because it is a reward peculiarly adapted to the nature of the service rendered, and adjusts itself with great nicety, so far as concerns the value of the reward or the patent itself, to the value of the service which the inventor has conferred. It is clear that if the invention is a new thing—and this is a necessary part of the assumption of the validity of the patent—then the grant to the inventor of the exclusive use of that new thing for a limited term has not taken from the public anything which it before possessed, but, in consideration of the limited monopoly, it has given to the public the benefit and knowledge of the invention, which is made of record and open to all to use after the expiration of the patent. Thus the right to secure an injunction under a patent becomes of value just in proportion exactly as the invention is of value. The difficulty that arises in estimating the value of any patent always comes in connection with a determination of the amount of damage recoverable for infringement which has taken place before the issue of injunction.

VALUE OF A PATENT TO THE PATENTEE CONSIDERED IN ITS COMMERCIAL ASPECTS

This value is really commensurate with the value to the general public; that is to say, the measure of value is the measure of utility of the invention itself; and it is largely from a failure to fully recognize this important point that the court decisions present such widely varying extremes in fixing the matter of damages. There are certain cases in which it has been made clear by the testimony that the entire value of the device sold was due to the fact that as a commercial article it included the patented invention; that is to say, that the article sold in accordance with the patent would have been entirely worthless without the invention. Such a situation obviously renders the patent of great value, as it then becomes the basis of the entire business. In other cases there may be but slight value attached, but sufficient to cause the patented article to sell at a slightly better price than other things available in the market of similar kind.

To the patentee himself a patent often has another value of a secondary character somewhat analogous to the commercial value of a trade-mark protection, because it may serve the purpose of helping a manufacturer to preserve some distinctive peculiarity in the appearance or character of his product.

Perhaps the most difficult situation under which to fix the distinct value of a patent arises where the invention defined in the patent, or the novel feature contributed to the art by such invention, constitutes but a part of some general structure embodying possibly a number of other inventions, all commonly sold in the trade as a whole article of commerce. Something of this situation existed in the refrigerator car case referred to. In that particular case the special features of invention had reference primarily to the use of a certain form of partition wall adjoining the ice chamber of the refrigerator car, and, of course, the car itself was made up of roof, sides, floor, doors, bolsters, trucks and brakes, all of which were included in the article as placed upon the market as a whole.

It is interesting to note that since the second decision was rendered the Court of Appeals for the Third Circuit, which heard the argument on this case some time ago, has rendered a decision in which it has taken ground intermediate between the master's recommendation of $663,000 and the lower court's award of 6 cents, and have calculated that the patentee is entitled to a recovery which apparently comes to a total of $41,000, this conclusion being based upon certain percentage calculations.

It appears from the Court of Appeals' decision that the car cost $914.38, without trucks, and that the profit thereon, after deducting material and labor and other manufacturing expense, was $171.74, which gave a proportion on the car which, expressed decimally, is 18.78 per cent., as a basis of calculating a profit assignable to any particular part of the cost of the car.

On some of the cars, amounting to several thousand, the testimony of one of the witnesses showed an average cost of the particular slotted partitions, which the court treats as constituting the special essence of the improvement, of $45. In the case of nearly 12,000 cars, it seems that the purchasers themselves furnished the partitions and the defendants in the suit had installed them when they built the cars. The view of this taken by the court seems to be that, while it is true that on these partitions defendants could not have made any profit, there was expended upon them a certain cost of labor in installing them, and on such cost of labor there should be calculated a proportional profit. It was calculated that such installation did not cost less for ordinary wages than $3 for each of the infringing partitions, and figuring from this, with the percentage basis of 18.78, there was derived a profit of something over 56 cents upon such labor of installing the partitions, and this on the cars on which such installation was made was calculated to produce a total of $6724.17. In view of all of which, taken from the report of the master in that part of his figures which were apparently approved by the Court of Appeals, it was found that the proper basis of recovery was the sum of the profits on the partitions made by the infringer and sold with the cars, such profit amounting to $34,623.74, and the profit on the labor involved in the installation of the other partitions, amounting to $6724.17, giving a total award against the infringer of $41,347.91.

By way of further explanation, it should perhaps be added that in determining the question of recoverable profits in any such accounting case, the figures are generally obtained by deducting from the net selling price the actual items of cost, including not only the labor and material involved in the construction, but also a certain percentage of overhead charges and selling expense, in some instances, and various other items entering into what is normally known as legitimate manufacturing cost.

On the other hand, because of certain peculiar rules which have become established in connection with accountings in patent suits, the profits which are found by the court to be the amount of recoverable judgment do not altogether correspond with the profits as they would be calculated in ordinary commercial usage. Thus, for example, while it is customary, in estimating the profits in these court proceedings, to deduct from the amount actually received for goods sold certain allowances for cost of material and actual labor expended, and certain other items, such as interest actually disbursed on money borrowed to carry on the infringing business, rental of buildings necessarily used in the manufacture, and certain salaries of parties who are paid employes, it has been held in many cases that no allowance will be made for the time and services of the infringing defend-

ant, or of either of the defendants, if the infringement is by a firm, even although legitimate salary has been paid. There are other cases in which the courts have refused to allow credit to the infringer for interest on capital invested in the general business, or the item of *insurance* even although this be upon the property actually employed in the infringement. Just what the reasoning may be which has justified some of the courts in allowing certain interest charges in some cases and refusing similar charges in others, and in altogether rejecting insurance expense, it is difficult to understand.

Another rule which it is important to bear in mind in this connection is that in most of the authorities the courts refuse to offset losses incurred in part of the infringing manufacture against profits on other infringing operations; that is to say, if for a certain period the infringing business was unprofitable, the loss can not be offset against profits made at another time. Thus, if the infringement extends through a series of years, the rule of most of the cases is that if losses be incurred in any one or more years, such losses can not be offset against profits made in other years.

Users of Infringed Patents.—Another feature that must be considered, in determining the commercial value of a patent to the patentee, is the hold which the patent gives him upon the infringing users after the validity of the patent has been sustained in court. It has been settled in various decisions, including cases in the U. S. Supreme Court, that the liability of an infringing *user* of a patented device is separate from the liability of the one who *made* and *sold* the device, and judgment against the maker or seller does not, in the absence of express stipulation, release the user of the infringing mechanism, and it is optional with the patentee, if he chooses to make settlement with the manufacturer without releasing the user and enforce his right to an injunction prohibiting any further use of the infringing apparatus by the purchaser. This is a matter of great importance to the railroad, because there is always present a danger that the issue of injunction against infringing apparatus may tie up their equipment; and it is on this account largely that, in cases where question arises, it is thought wise by many roads to insist upon the requirements of a bond to indemnify the road against damage in case of any interference with apparatus which is alleged to infringe outstanding patents.

Among the most interesting cases along this line which have come to my notice may be mentioned the case of the Westinghouse Air Brake Company vs. The Great Northern Railway, about fifteen or sixteen years ago, in which one of the judges of the U. S. Circuit Court, in an order which was afterward affirmed by the Court of Appeals in New York, issued a decree requiring the removal of air-brake triple valves which had been found to infringe the Westinghouse quick-action patents, from some thousands of cars, the order being modified slightly, however, to allow limited time to make the change because of the great inconvenience to the general public which would have been incurred had the equipment all been taken out of service at once.

In affirming this decision the Court of Appeals called special attention to the fact that, the railroad having had notice of infringement, it became a deliberate user of a large number of infringing triple valves, and had preferred to run the risk of an injunction rather than to change its equipment. In rendering the decision on appeal, the Court of Appeals referred back to an earlier case along similar lines, in which the Court said:

"'I can not in the decree do less than give the plaintiff his full right, and I can not bargain for him what he may choose or may not choose to do.' It does not lie with the infringer to say that the owner of the patent will be fully compensated by a money recovery, and ought to be satisfied thereby. It is for the latter to say whether he prefers an injunction or a money recovery, or both; and, at his option, he is at liberty, at final hearing, to waive an account and insist upon his injunction."

It is very interesting to observe the great changes which have taken place within a period of, say, about ten years in the matter of recovery of damages in patent cases. A few years ago, the question was brought up to the U. S. Supreme Court, in a suit known as Westinghouse vs. Wagner Electric Co. They held that where the patentee had shown there was commercial value in his patent, but that he was unable to segregate or separate that value from other values in the device of the infringer, that then the infringer, being the party in the wrong, should assume the burden of producing figures intended to show a basis for determining the question of recovery.

At the present time the tendency of the decisions in most of the courts seems to be to try and find a middle ground and apply more reasonable and moderate rules, and to base results somewhat upon what may be called the calculation and estimate method, supported, if necessary, by expert evidence as to values not deducible in actual dollars and cents in certain phases of the figures. Without expressing any opinion one way or the other as to the accuracy or correctness of the conclusion finally reached by the Court of Appeals in the Third Circuit, in the decision on the refrigerator-car case referred to, it is thought that the effort therein made by the court to find a reasonable ground upon which to stand and to avoid a position which would be too extreme one way or the other, is very strongly deserving of commendation.

It is clear that the award of excessive and confiscatory recoveries in cases of infringement would tend rather to decidedly discourage the progress of science and the useful arts by imposing penalties so heavy as to drive capital and enterprising managers out of the manufacturing industries.

VALUE OF A PATENT AS BETWEEN EMPLOYER AND EMPLOYE

Taking up for consideration next the question as to how to fix a value upon patented inventions of employes where they are made use of by the employer, and where generally developed by the employes in connection with their employment and in the regular course of duty, it is to be observed that the law herein establishes certain fundamentals, the first of which is that the making of a new invention under such circumstances does *not*, in the absence of special agreement, give the employer a right to entire ownership of such patent. It does, however, recognize in some cases what is called an implied license or shop right, giving the employer the privilege of *using* the invention within certain limitations dependent upon the facts of the particular case.

In order to avoid confusion and controversy, and to protect the rights and interests of both parties, some of the railroads in this country have considered the advisability of arranging definite written service agreements with employes such as are engaged in that class of work which would probably lead to the development of new improvements; and it is undoubtedly to the interest of both the railroad and the employe that such agreements be made upon a just and equitable basis, which reason dictates should leave the ownership of the patent within the hands of the employe, limted only by a license right in the road to use the invention upon its own lines and in its own service.

One advantage to the railroads in having new devices invented by their employes covered by letters patent under some such service agreement is that the taking out of such letters patent, which involves the making of record in the Patent Office at Washington a full disclosure of the invention itself in the specifications and drawings, is one of the surest and best means for protecting the railroads against claims that may be advanced by other inventors, who may secure patents either fraudulently or otherwise on such improvements.

Of course, the above analysis of the law and principles applicable to this matter of fixing a value upon letters patent might be extended indefinitely, but that is beyond the scope of a paper of this general character.

TRAIN LIGHTING

One of the most important items that the committee has under consideration in this year's report is the standardization of armature pulleys. The committee held a joint meeting with the committee on standards of the Association of Railway Electrical Engineers and with the representatives of the various axle dynamo manufacturing companies.

The committee recommends the following changes and additions to the present Recommended Practice:

That paragraph 12, under the caption, "Control and Protection of Parts," page 943, 1914 Proceedings, be changed so as to apply to wooden cars. Paragraph to read as follows: 'That on wooden cars, where axle dynamos are used, negative, positive and field shall be fused as close as possible to the dynamo and prior to the said leads either entering the conduits or being secured to the bottom of the car. The above fuses to be used for emergency service only, and to be at least 100 per cent above the capacity of the fuses on the switchboard protecting the same leads."

That a paragraph be added following paragraph 19, under the caption of "Batteries," page 944, 1914 Proceedings, to read as follows: "Battery boxes shall have the following minimum dimensions: Height in clear, 21½ in.; depth front to back, 2 ft. 1 in. Length of compartment to hold two standard double-compartment trays, 22⅝ in. Length of compartment to hold four standard double-compartment trays, 3 ft. 9¼ in."

That a paragraph be added following paragraph 28, under the caption "Axle Dynamos," page 945, 1914 Proceedings, reading as follows: "On all new and remodeled axle dynamos provided with ball or roller bearings, armature pulleys shall be in accordance with dimensions as shown in Fig. 1." This provides for either an 8 in. or 11 in. pulley.

That after this paragraph the following paragraph be added: "In all new or remodeled ball or roller bearing axle dynamos the details of the pulley end of the armature shaft shall be in accordance with the dimensions as shown in Fig. 2."

That following the paragraph recommended above an additional paragraph should be added, reading as follows:

"On all sleeve-bearing generators having armature shaft less than 1⅝ in. in diameter at the inside end of the pulley fit, it is recommended that taper fit of ¾ in. in 12 in. be used; the inside dimension of the taper fit being 1½ in., with a length of 2½ in., measured on the axis of the shaft." The committee makes the foregoing recommendations in order to assist in the standardization of the armature pulleys on existing machines, it being necessary to establish a standard with smaller dimensions than the proposed standard for ball and roller bearing machines on account of the size of the shaft.

That following the above recommendation a paragraph should be added reading as follows: "On all future and remodeled ball and roller bearing axle dynamos, the roller or ball bearing in annular ball-bearing size used shall be that known as No. 412."

That paragraph 4, page 940, 1914 Proceedings, be changed to read as follows: "That in wiring cars for electric lighting, all the wire shall be run in conduits, and the conduit shall be so installed that the wires can be pulled in and pulled out of the conduit after the car is completed." The committee feels that the above recommendation is desirable in view of the present state of the art.

That paragraph 20, page 944, under the caption of "Axle Dynamos," the last sentence in this paragraph to be rewritten, omitting the word "perforated," paragraph then reading as follows: "The generator pulley should be flanged and crowned, and have a 7-in. face. The diameter of axle pulleys should preferably be 17 in. or 21 in.; the diameter of the generator pulley should preferably be 8 in. or 11 in."

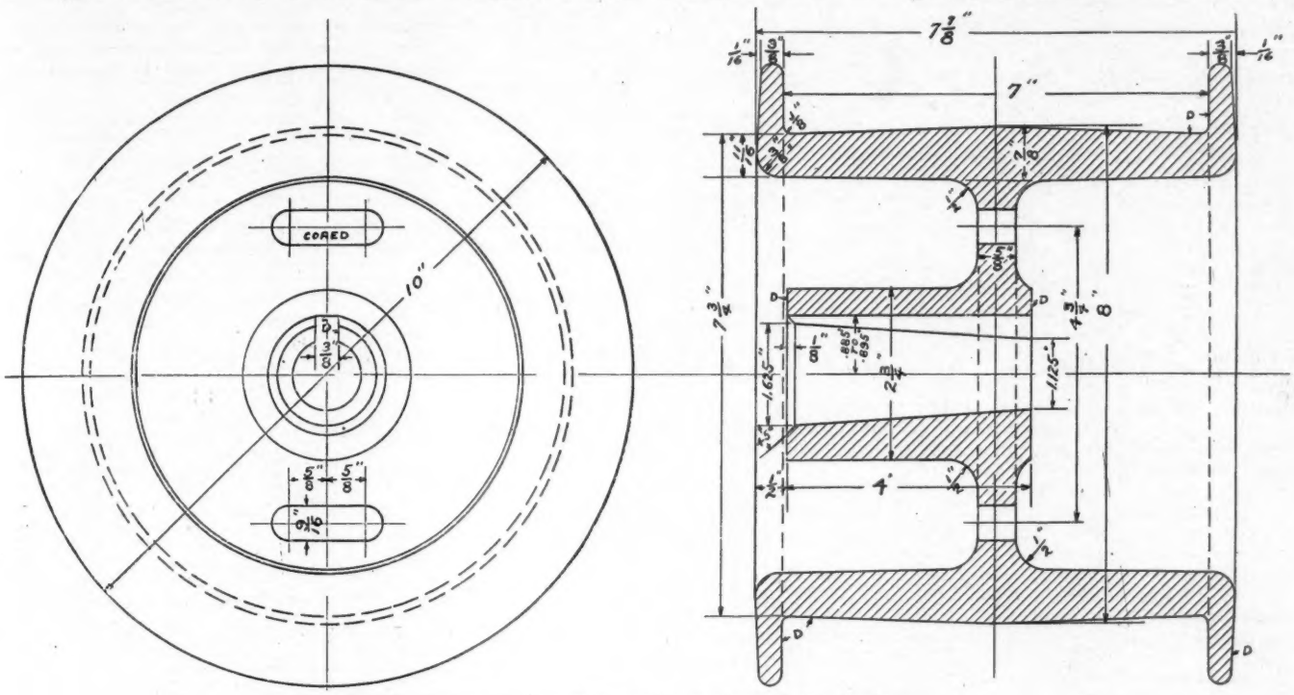


Fig. 1.—Armature Pulleys for Axle Lighting Systems

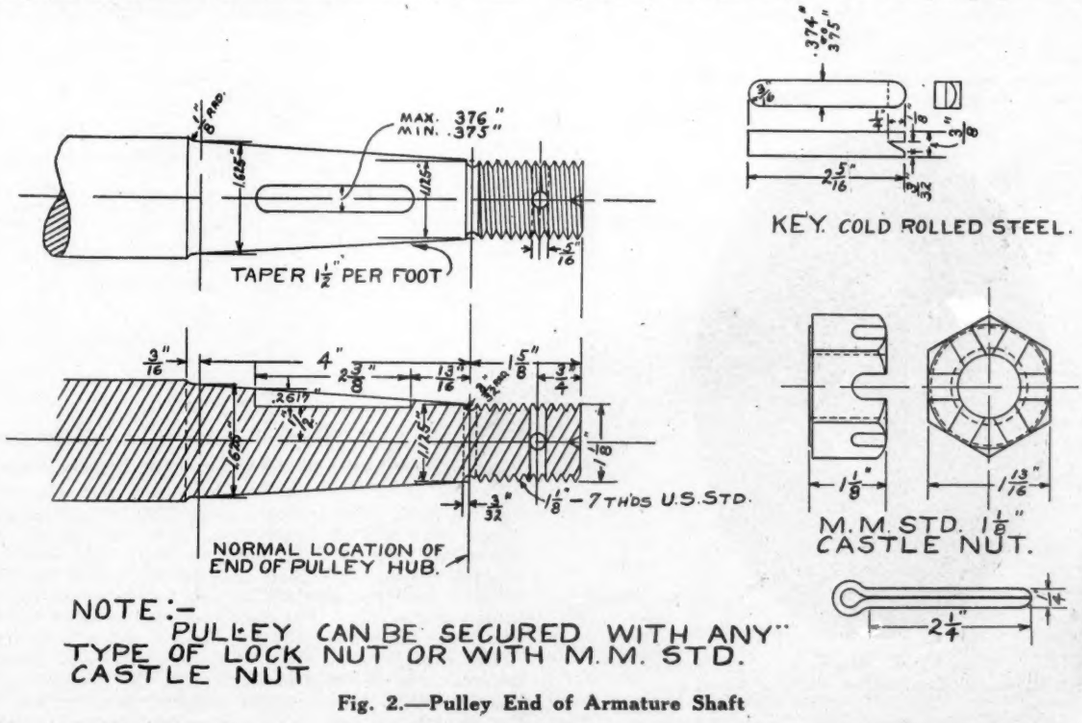

MAX. .376"
MIN. .375"
TAPER 1½" PER FOOT
4"
NORMAL LOCATION OF END OF PULLEY HUB.
1⅛" - 7 THDS U.S.STD.
KEY. COLD ROLLED STEEL.
M.M.STD. 1⅛" CASTLE NUT.
NOTE:- PULLEY CAN BE SECURED WITH ANY TYPE OF LOCK NUT OR WITH M.M. STD. CASTLE NUT

Fig. 2.—Pulley End of Armature Shaft

The committee recommends that the foregoing items be submitted to letter ballot separately.

The report is signed by:—T. R. Cook (Penn.), chairman; H. C. Meloy (N. Y. C.); Ward Barnum (L. & N.); D. J. Cartwright (L. V.); E. W. Jansen (I. C.); J. H. Davis (B. & O.), and C. H. Quinn (N. & W.).

(In the absence of the chairman the report was presented by H. C. Meloy, N. Y. C.)

DISCUSSION.

C. H. Quinn (N. & W.): As a member of the minority section of this committee, I would like to call your attention to the fact that in recommending 1½ in. taper in 12, statistics will show that at present there are more machines in service with a ¾ in. taper than with a 1½ in. taper. As a mechanical proposition it would be much easier to turn down 1½ in. taper to ¾ in. taper, than to increase from ¾ in. to 1½ in. I think the mechanical practice, as usually carried on in our machine shops for drill center and lathe center, more nearly fits the ¾ in. taper in 12. In a mechanical proposition of this kind I would be governed by the practice of tool builders and other men who have made a particular study of the item rather than to arbitrarily accept 1½ in. in 12. As I take the report it is a question of whether we shall vote on accepting the 1½ in. taper or nothing. I do not see any reference to the opportunity of accepting ¾ in. and it is not standard at the present time. There is now no standard.

G. W. Wildin (N. Y., N. H. & H.): I would like to ask if, in stipulating a minimum diameter of 8 in. for the armature shaft pulley, we are not cutting out certain manufacturers of high speed machines?

H. C. Meloy: The committee understood in talking with the various manufacturers that they would furnish any taper desired, or any pulley diameter desired, and the question of body suspension was not up at the time of the meeting. This only refers to truck suspension.

C. H. Quinn: Probably there will have to be taken under consideration in the next year's report, if this committee is continued, the diameter of pulley covering the body suspended machine. There seems to be a tendency for the standardization of dynamos in reference to speed and temperature. If we can bring about such a standard that will more or less settle the recommended practice for a body suspended machine. (It was voted to refer the report to letter ballot.)

CAR TRUCKS

At the last convention the recommendations of the committee were received and submitted to letter ballot.

The majority of the items which were rejected were defeated by a very small number of votes, and, in order to ascertain the objections of the members who voted in the negative, a communication was addressed to them to ascertain their specific

J. T. Wallis
Chairman, Committee on Car Trucks

objections, with a view of reconciling the differences as far as may be practicable. The replies received were given careful consideration, and as a result of this investigation, as well as further tests made and conferences with the manufacturers of cast-steel truck sides and bolsters, the committee presents the changes it recommends, under the respective headings.

SPECIFICATIONS AND TESTS OF CAST-STEEL SIDES

The committee modified the clause providing for a proof load test on each truck side to requiring a minimum of one frame from each melt, and not less than 2 per cent. of the total frames furnished to be subject to the proof test, resubmitting it as follows:

Under Article III, Physical Properties and Tests, after Section 10, Physical Properties, add new section for Proof Test, as follows:

Proof Test.—A minimum of one frame from each heat and not less than 2 per cent. of the total frames furnished shall be tested in a suitable machine to the loads shown in the table for different capacity car trucks.

Car Capacity.	Initial Load.	Load.	Maximum Deflection.	Maximum Set.
Lb.	Lb.	Lb.	In.	In.
80 000	20 000	110 000	0.15	0.01
100 000	25 000	135 000	0.15	0.01
140 000	35 000	175 000	0.15	0.01

After applying initial load, reduce load to 5000 lb. and set deflection instrument at zero; apply the requisite proof load and

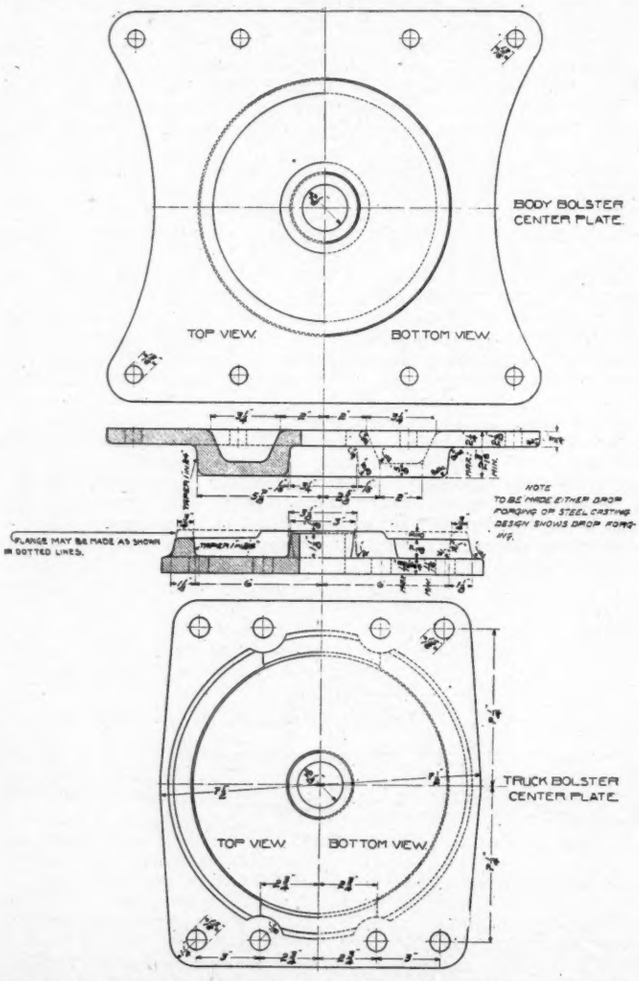

BODY BOLSTER CENTER PLATE
TOP VIEW
BOTTOM VIEW
NOTE
TO BE MADE EITHER DROP FORGING OR STEEL CASTING DESIGN SHOWS DROP FORGING.
FLANGE MAY BE MADE AS SHOWN IN DOTTED LINES.
TRUCK BOLSTER CENTER PLATE
TOP VIEW
BOTTOM VIEW

Fig. 2.—M. C. B. Standard Center Plates for 80,000, 100,000 and 140,000 Lbs. Capacity Freight Cars

measure deflection; reduce load to 5000 lb. and measure the set. Truck sides may be supported at each end, directly beneath the center line corresponding to center line of axle when side frame is in the truck and loaded at center of bolster opening midway between supports, or they may be supported in the center and loaded at the ends. The deflection and set shall be measured at the center line of spring seat.

The committee carefully reviewed the weights recommended last year, and had a large number of side frames for 100,000-lb. and 140,000-lb. capacity cars weighed and checked, and found the weights recommended last year practically correct. The same opportunity was not afforded on the side frames for 80,000-lb. capacity cars, and it is believed, therefore, that the limiting weights on the latter should be held in abeyance until the actual weights can be positively determined. For side frames for the 100,000-lb. and 140,000-lb. capacity cars the com-

mittee recommends that under Article IV, Weights, Section 13, Variation in Weights (new number 14), change to read as follows:

Limiting Weights.—Truck sides shall conform to the weights given in table. In case the castings have met all requirements except that of overweight, they may be accepted at the maximum allowable weight here specified:

Car Capacity. Lb.	Weights, Lb. Minimum.	Normal.	Maximum.
100 000	485	500	515
140 000	640	660	680

The present recommended practice covering rejection should be changed to conform with the change recommended in the proof test, and the committee therefore suggests the following modification:

Rejection.—In case the test pieces do not meet the specifications, all castings from the entire melt shall be rejected. If the side frame selected to represent a melt does not meet the proof test, then all the frames from that melt shall be subjected to the proof test, and any such frames failing to meet the test shall be rejected.

DESIGN OF CAST-STEEL BOLSTERS FOR 80,000, 100,000 AND 140,000 LB. CAPACITY CARS

The design of each of the above bolsters failed to be adopted by 117 votes. The main objection of the members who voted in the negative is that the detachable center-plate adds weight and that the trouble experienced with center-plate cast integral is not sufficient to warrant the added expense of the independent center-plate. As this feature does not in any way affect the interchangeability, the committee, upon further consideration, feels that this matter should be left optional with the car owner. This involves two designs of bolsters, slightly different in detail but both conforming to the limiting dimensions, and, therefore, interchangeable. [The committee presented drawings of both designs for adoption.—EDITOR.]

The question was also raised in regard to having insufficient support under the center-plate. This had been tested out, and no failures occurred with the design as presented.

Under Article III, Weights, change Section 13 to read as follows:

Limiting Weights.—Bolsters shall conform to the weights given in table which cover the bolster casting, either with center-plate cast integral or separate center-plate, and does not include side bearings, fulcrum castings, or other attachments. In case the castings have met all requirements except that of overweight, they may be accepted at the maximum allowable weight specified.

Car Capacity. Lb.	Weights, Lb. Minimum.	Normal.	Maximum.
80 000	600	710	730
100 000	750	775	800
140 000	970	1 000	1 030

(The above weights are tentative. Several bolsters have been ordered which will be carefully weighed and two tables will be substituted. One covering bolsters with separate center plates and the other covering center plates cast integral.)

PRESSED-STEEL TRUCK BOLSTERS FOR 80,000, 100,000 AND 140,000 LB. CAPACITY CARS. ALTERNATE STANDARD

The replies to the circular letter asking for specific objections to the pressed-steel bolsters presented by the committee to the last convention indicated that the members voting in the negative on the pressed-steel bolsters did so for the reason that they did not approve of certain details on the cast-steel bolsters. The committee suggests that the pressed-steel bolsters should be treated and considered as a separate problem. If a cast-steel bolster is preferred by a car owner, it should not affect the status of the pressed-steel bolster, and vice versa. The two proposed standards are interchangeable, but it is not to be assumed, nor is it the intention, to permit the substitution of one for the other in repairs; the idea in establishing the two standards is to give to car owners the choice of either a cast-steel or pressed-steel bolster of approved design. The committee tested four bolsters of each capacity, which met the tests in every respect. From these bolsters the average weight was computed. It was, therefore, recommended to submit to letter ballot the following:

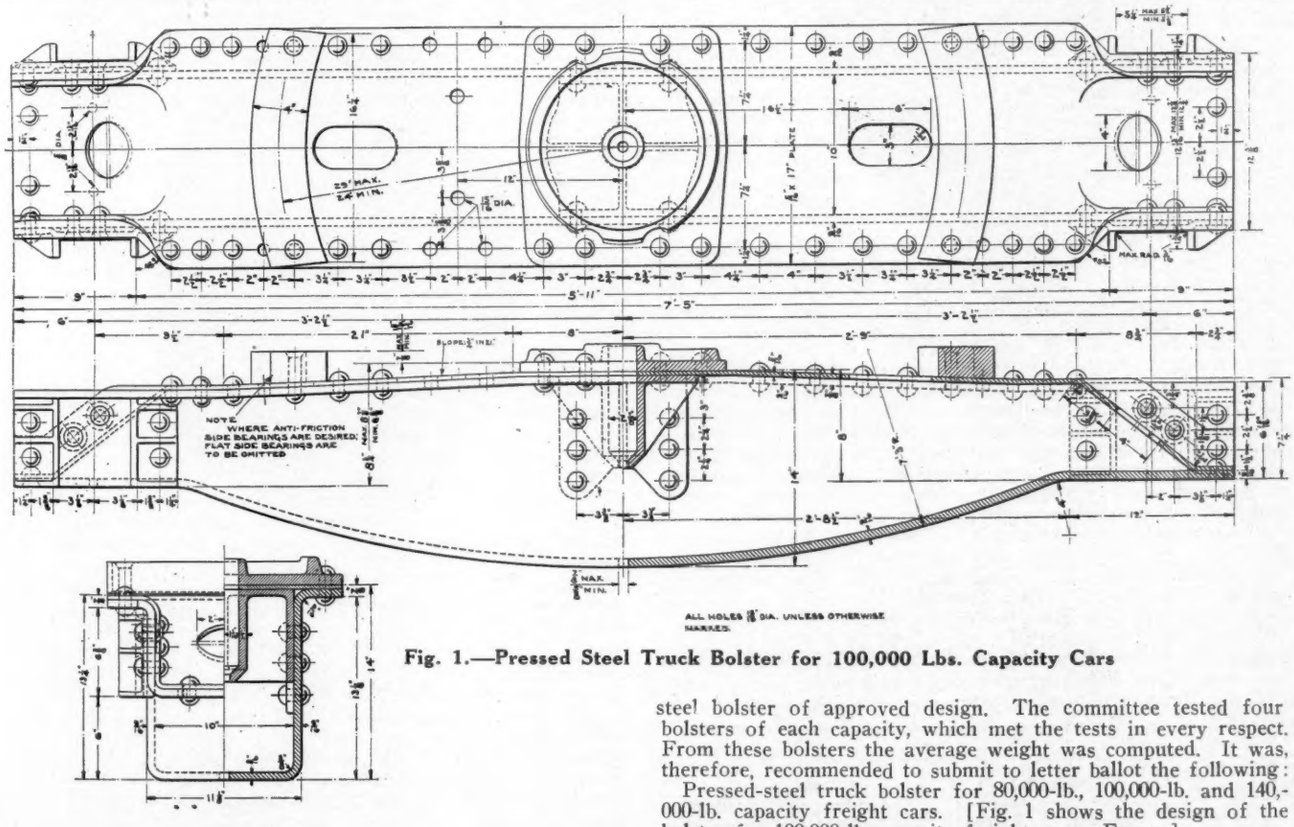

NOTE
WHERE ANTI-FRICTION SIDE BEARINGS ARE DESIRED FLAT SIDE BEARINGS ARE TO BE OMITTED
ALL HOLES 1" DIA. UNLESS OTHERWISE MARKED.

Fig. 1.—Pressed Steel Truck Bolster for 100,000 Lbs. Capacity Cars

Pressed-steel truck bolster for 80,000-lb., 100,000-lb. and 140,000-lb. capacity freight cars. [Fig. 1 shows the design of the bolster for 100,000-lb. capacity freight cars.—EDITOR.]

Specifications and Tests.—The steel should conform to the requirements of the M. C. B. specifications and tests for structural steel for freight cars.

Limiting Weights.—Bolsters, including center-plate and side bearings, shall conform to the weights given in table. In case the bolsters have met all requirements except that of overweight, they may be accepted at the maximum allowable weight here specified.

Car Capacity. Lb.	Weights, Lb. Minimum.	Normal.	Maximum.
80 000	775	795	815
100 000	840	865	890
140 000	1 110	1 140	1 170

SPREAD OF SIDE BEARINGS

It is customary and proper to assume that the height of center of gravity of a loaded car may reach 6 ft. above top of rail. It has also been determined from actual test that the height of center of gravity above top of rail occasionally reaches 7 ft. Following customary practice, based on height of center of grav-

ity of 6 ft., and making proper deduction for truck weight to determine height of center of gravity of loaded body alone above the level of the side bearings, it has been determined that the radial distance from center-plate to side bearing must be at least 24 in. (or 48 in. center to center of side bearings), in order to avoid overturning of body on side bearings before the whole car tends to overturn on the rail, the spread or gage of the rails being the accepted limiting feature. It is, therefore, recommended to submit to letter ballot the following: "That the side-bearing spacing, center to center of side bearing, be within the limits of 48 in. to 58 in., both inclusive, on the M. C. B. design of bolsters."

CENTER-PLATES AND GAGES FOR 80,000, 100,000 AND 140,000 LB. CAPACITY CARS

The change in center-plates failed to receive the necessary two-thirds vote by 118 votes. The main objections of those voting "no" are the height of ring on the outside of center-plate being too low and insufficient radial clearance between the male and female center-plates. The design has been changed, providing for a uniform height of flange of 1¼ in. on the outer ring of the female center-plates and the radial diameters changed so as to provide a total clearance of ¼ in. instead of ⅛ in., as at present, and preserving interchangeability with present M. C. B. standard center-plate. The center-plate shown in Fig. 2 was recommended for adoption as standard.

TRUCK SIDES WITH PEDESTAL TYPE JAW

It has been brought to the attention of your committee that there are in use a large number of cast-steel truck sides designed with a pedestal jaw, to keep the journal box in place, and doing away with the regular journal-box bolts, and a request has been made that the committee outline limiting dimensions for the pedestal jaw as an alternate for the present limiting dimensions of side frame adjacent to the journal box; also limiting dimensions for journal boxes used in connection with side frames having pedestal jaw.

The committee has made some preliminary investigations among the manufacturers and finds that the interchangeability of boxes presents a difficult problem. Before going into the question further the committee desires to ascertain by a letter-ballot vote whether, in the opinion of the members of the Association, the benefits to be derived from the pedestal-jaw design of side frame is sufficient to warrant establishing the additional standards, which involve carrying in stock the additional material necessary to make repairs to this type of side frames. Three of the four manufacturers advise that up to the present time 243,261 pedestal side frames have been placed in service.

In order to prepare for the adoption of limiting dimensions of pedestal opening and width of box, also for the width of pedestal jaw and corresponding width between pedestal slide on journal box, your committee has canvassed the situation and finds that the various manufacturers of cast steel truck sides with pedestal type jaw are at the present time turning out frames in which the dimensions above referred to for the various capacity cars are practically uniform. It is very desirable that these dimensions be maintained and would, therefore, suggest to the members who are now using the pedestal type of cast steel frame and those who may purchase any in the future that the limiting dimensions shown in the following table be specified.

CAPACITY OF TRUCK	TRUCK FRAME				JOURNAL BOX			
	Jaw Opening		Width of Pedestal		Jaw Opening		Width of Pedestal	
	Max. Ins.	Min. Ins.	Max. Ins.	Min. Ins.	Max. Ins.	Min. Ins.	Max. Ins.	Min. Ins.
40 Ton.....	9 3/16	9 1/16	3 5/8	3 9/16	9	8 15/16	3 3/4	3 11/16
50 Ton.....	9 3/16	9 1/16	3 3/4	3 7/16	9	8 15/16	3 3/4	3 13/16
70 Ton.....	10 1/16	10 1/16	4 1/2	4 7/16	10 1/2	10 7/16	4 3/8	4 5/16

The report is signed by:—J. T. Wallis (Penn.), chairman; E. W. Pratt (C. & N. W.); Jas. Coleman (G. T.); J. J. Tatum (B. & O.); Prof. E. C. Schmidt (Univ. of Ill.); L. C. Ord (C. P. R.); J. McMullin (Erie); A. R. Ayers (N. Y. C.), and E. G. Chenoweth (C., R. I. & P.).

The report was presented by A. R. Ayers, N. Y. C. Referring to the limiting weights of cast steel bolsters, he said: After the sample bolsters were received it was evident that it would be better to have two tables, one for integral center plate and another for bolsters with separate center plate, because the design with the integral center plate will be somewhat lighter. The committee will undertake to draw up two tables and include them in the report. Several bolsters of each design have been ordered, so that the weight can be checked carefully

DISCUSSION

C. F. Giles (L. & N.): What consideration has been given to the cast steel side frame with the box cast integral, and what bearing will the report have on that type of frame, if any?

A. R. Ayers: I do not think the conditions are such that we could incorporate that design if this should become standard. That is a special construction, it is only made by one manufacturer.

C. F. Giles: We have many thousands of cast steel truck bolsters in service throughout the country, and I do not know of a single case where they have a separate center casting. I am at a loss to know why the committee recommends such a design. We have had a wide experience with the bolster with the center cast integral, and it is entirely satisfactory. If a bolster with separate center casting is adopted it will complicate the situation in asking for bids, in the purchase of new equipment. We will have to add to the bolster with the separate center plate the difference between the cost of the integral bolster and that of a bolster with a separate center plate, which would add at least $5 or $6 to the cost of the car.

F. W. Brazier (N. Y. C.): My experience has been in favor of the bearing cast integral. With this type, however, you are bound to have wear, and in time there will be no way of replacing the center plate. Where the center plate is lipped over the side of the body bolster, and properly bolted, you will have a chance, if it wears out, to replace it.

R. L. Kleine: The report of the truck committee was lost in the letter ballot last year because some of the members preferred cast steel truck bolsters with the center plates integral. For that reason the committee give the members three options; the pressed steel bolster, the cast steel bolster with the center plate detachable, and the cast steel bolster with the center plate cast integral. They are interchangeable, in so far as dimensions go.

A. R. Ayers: The pedestal and truck is on the market, and there are several hundred thousands of them in service at the present time. The width of jaw and the width of the face of the jaw has been made uniform by all the manufacturers of this form of truck, although the box fastenings are different. There are apparently certain advantages for that form of truck in doing away with the journal box bolts. If they prove to be real advantages, this type of truck will find its place whether or not it is an M. C. B. standard. If the dimensions which are at the present time uniform can be maintained, the problem of adopting a single fastening for a box will be very much simplified and will be an entire possibility in the near future if the association desires to have such a single standard adopted, in which case it would only introduce an additional standard for each size of box.

C. F. Giles: We are using a pedestal style of truck very largely. The principal object was to do away with the journal box bolts which results in the bolts being battered up and having to be renewed. As far as the journal box fastening is concerned it is absolutely unnecessary except in case of a derailment.

(The report was referred to letter ballot.)

DRAFT EQUIPMENT

The accompanying table is made up from replies received to twenty questions sent out in a circular of inquiry for the purpose of finding out general practices and the general weaknesses of the present draft gear appliances.

Sixty per cent. of the total number of cars are of steel center sill construction and are equipped with friction draft gear from a minimum of 100,000 lb. to a maximum of 260,000 lb. capacity. The capacity of these cars varies from 80,000 to 120,000 lb. The question is involved whether the construction of a car is taken into consideration when a decision is being reached as to the capacity of the gear to be applied. It is evident that a draft gear of low capacity necessitates a better construction of car in order to take care of the shocks, which are meant to be absorbed by the gear.

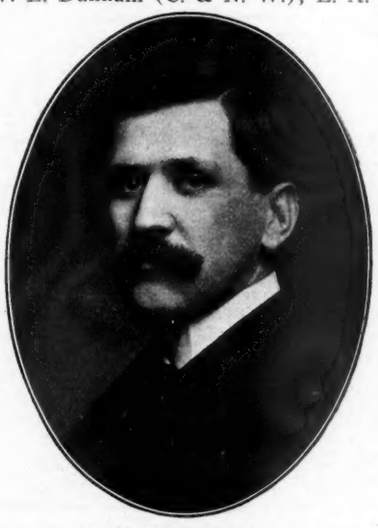
Eighty per cent. of the total replies show preference for a friction draw gear on new equipment. Thirty-six per cent. of the replies express a preference for more coupler travel than the present standard of 2¾ in. between coupler horn and striking plate.

The matter of keeping up nuts on drawbar carry-iron bolts is a great source of trouble. Almost all who advise no trouble in that respect are using nut locks, while some of the largest roads are overcoming this trouble by placing these bolts in shear instead of in tension as has been the general practice.

The following is an abstract of the replies to the twenty questions sent out:

Number of freight cars involved (all types)	956,879
All steel center sills	340,862
All wood center sills	169,915
Wood sills and metal arms	68,111
Friction draft gear	453,725
Spring draft gear	497,874
Wooden cars equipped with higher capacity draft gears or reinforcement	741,018
Failures of drawbar yokes with semi-circular backs	Yes—290,924 / No —179,300
Failures of drawbar yokes with square backs and liner	Yes—618,409 / No —208,201
Drawbar yoke 1¼ in. rivets failing, high capacity gears	Yes—718,124 / No —155,887
Trouble with keys in place of rivets in yokes	Yes— 59,951 / No —320,276
Trouble with draft gears depending on rivets instead of yokes	Yes—182,139 / No —328,044
Friction draft gear preferred on new cars	772,219
Spring draft gears preferred on new cars	22,579
Number of recommendations for coupler travel on high capacity friction draft gears of over 2¾ in.	2 in. to 3 in.—19,983 / 2¼ in. to 3 in.—23,757 / 2½ in. to 3¾ in.— 4,159 / 2¾ in. to 3½ in.—18,387 / 3 in. to 3½ in.—31,669 / 3 in. to 3¼ in.—67,452
Difficulty in keeping up nuts on carry-iron bolts	Yes—672,272 / No —271,239
Speed limit on engines in switching service or cars in hump yards	Yes—241,928 / No —680,518

The report is signed by:—J. F. DeVoy (C. M. & St. P.), chairman; W. E. Dunham (C. & N. W.); E. A. Gilbert (So. Pac.); J. R. Onderdonk (B. & O.); A. R. Kipp (M. St. P. & S. S. M.); G. W. Rink (C. of N. J.), and P. F. Smith, Jr. (Penn. Lines).



J. F. De Voy
Chairman, Committee on Draft Gear

(In the absence of the chairman the report was presented by W. E. Dunham, who called attention to the apparent lack of information indicated by the replies to several of the questions in the committee's circular of inquiry and requested that the members make some detailed investigations for its benefit should it be continued for another year. (The recommendation of the committee that it be continued was referred to the executive committee.)

JOINT MEETINGS

[This report is a duplicate of that presented at the M. M. Association—see *Daily Railway Age Gazette* of June 12, 1915. —ED.]

DISCUSSION.

M. K. Barnum (B. & O.): The committee has done considerable work that is very interesting, but it seems to me that it is possible to go a little further with the result of saving some duplication of work and some time for the convention, and I believe it is a subject worthy of further consideration. I move that the committee be continued and enlarged and requested to report at the next convention.

T. H. Goodnow: The committee was simply appointed to work up a program for the two associations, so in view of what Mr. Barnum says he might wish to enlarge the scope of the committee.

M. K. Barnum: I suggest that the committee be instructed to consider the subject in its broader aspect and make a report on such lines as it shall see fit.

(The motion was carried.)

IMPACT BETWEEN FREIGHT CARS IN SWITHCHING SERVICE

By LOUIS C. ENDSLEY

Professor of Railway Mechanical Engineering University of Pittsburgh

The purpose of these experiments was to determine this force of impact by obtaining the acceleration of the car during the impact blow. The instrument used to obtain the acceleration of the car during the impact consists of a cylinder mounted on two supports. These supports also carry a rest upon which a slide moved. This slide had mounted in it a lead pencil. The slide was so constructed that it could be connected to the car by means of a rod. The cylinder could be driven at almost any desired speed by a motor, which received its current from a six-volt storage battery. The speed selected for these tests was 45 revolutions of the cylinder per minute. As the cylinder was 20 in. in circumference, this gave a speed for the paper of approximately 15 in. per second.

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L. E. Endsley
Paper on Impact between Freight Cars in Switching Service

The tests were made with a string of eight or ten cars placed on a track that had just sufficient grade to keep a car in motion after it had been started and not enough to accelerate the car. The brakes on the last two cars on the down-grade end were set and a locomotive was coupled on the up-grade end and the slack was pushed in until just the draft-gear movement was left between each car. The end car was then disconnected and pulled up the track some distance, the chronograph having been

WEIGHT OF CAR "B" 48000 LBS

VELOCITY OF CAR "A" IN FT PER SEC.	SPEED OF CAR "A" IN M.P.H. AT IMPACT	MAXIMUM VELOCITY OF CAR "B" IN FT PER SEC.	MAXIMUM SPEED OF CAR "B" IN M.P.H.	KINETIC ENERGY IN FOOT-POUNDS OF CAR "A"	MAXIMUM KINETIC ENERGY IN FOOT-POUNDS OF CAR "B"	MAXIMUM PRESSURE FROM ACCELERATION CURVE
I	II	III	IV	V	VI	VII
1.35	.92	.67	.46	1355	344	12,600
2.50	1.70	.97	.66	4650	718	30,200
2.86	1.95	1.07	.73	6090	860	32,800
3.57	2.43	1.64	1.12	9500	2030	41,500
3.90	2.66	1.81	1.23	11320	2480	66,750
4.48	3.06	1.99	1.36	14900	2990	60,400
5.00	3.41	2.48	1.69	18600	4640	90,600
5.00	3.41	2.30	1.57	18600	3990	81,750
6.00	4.09	2.90	1.98	26800	6350	107,000
7.15	4.87	3.49	2.48	38100	9200	129,500
8.12	5.54	3.30	2.25	49200	8150	158,500

Fig. 1—Table of Results on the Light Pennsylvania Cars

connected to the end car of those standing, the motor was then started and the drum allowed to revolve. The car that the engine had pulled up the track was pushed down the track with the engine disconnected. The car was then allowed to drift into the string of stationary cars. The speed of the moving car was determined by stop-watches, the time of the movement of the last 30 ft. being noted by two stop-watches. The velocity and acceleration of the first standing car was obtained from the record made on the cylinder of the chronograph. The above tests were made on Norfolk & Western 90-ton cars and Pennsylvania 55-ton cars, both kind of cars being tested light and loaded. The tests on the Norfolk & Western cars were made

WEIGHT OF CAR "B" 60 000 LBS

VELOCITY OF CAR "A" IN FT PER SEC.	SPEED OF CAR "A" IN M.P.H. AT IMPACT	MAXIMUM VELOCITY OF CAR "B" IN FT. PER SEC	MAXIMUM SPEED OF CAR "B" IN M.P.H.	KINETIC ENERGY IN FOOT-POUNDS OF CAR "A"	MAXIMUM KINETIC ENERGY IN FOOT-POUNDS OF CAR "B"	MAXIMUM PRESSURE FROM ACCELERATION CURVE.
I	II	III	IV	V	VI	VII
3.26	2.22	1.25	.85	9900	1460	101,000
4.62	3.15	2.62	1.78	19800	6400	164,000
5.00	3.41	2.37	1.61	23400	5240	128,800
5.26	3.59	2.77	1.88	25800	7150	181,500
5.56	3.79	2.72	1.85	28800	7000	141,000
6.00	4.09	3.32	2.26	33600	10300	184,500
6.25	4.26	3.33	2.27	36400	10400	204,000
6.25	4.26	3.39	2.31	36400	10700	198,500
7.50	5.12	3.16	2.15	52400	9300	222,000
7.90	5.39	4.46	3.04	58100	18600	313,000
8.83	6.02	4.94	3.36	72800	22700	468,000

Fig. 2—Table of Results on the Light Norfolk & Western Cars

at Roanoke, Va., and the test on the Pennsylvania cars was made at Conway, Pa.

For the purpose of distinguishing the different cars referred to in the paper, the moving car will be called *A*, the first car of those standing, *B*, the second standing car, *C*, the third standing car, *D*, etc.

The instrument was connected to car *B*, which was the first car in the cut of standing cars. It is a well-known law in physics that if you know the weight of a body and its acceleration, you can determine the force acting on the body. In each

WEIGHT OF CAR "B" 143300 LBS.

VELOCITY OF CAR "A" IN FT PER SEC.	SPEED OF CAR "A" IN M.P.H. AT IMPACT	MAXIMUM VELOCITY OF CAR "B" IN FT. PER SEC.	MAXIMUM SPEED OF CAR "B" IN M.P.H.	KINETIC ENERGY IN FOOT-POUNDS OF CAR "A"	MAXIMUM KINETIC ENERGY IN FOOT-POUNDS OF CAR "B"	MAXIMUM PRESSURE FROM ACCELERATION CURVE
I	II	III	IV	V	VI	VII
2.75	1.87	1.75	1.19	16,500	6,820	119,100
2.80	1.91	1.71	1.16	17,120	6,510	104,000
3.37	2.30	2.04	1.39	24,800	9,270	137,000
3.45	2.35	2.04	1.39	26,000	9,270	167,000
3.85	2.62	2.32	1.58	32,400	12,000	264,000
4.28	2.92	2.52	1.72	40,000	14,150	278,000
4.42	3.01	2.61	1.78	42,700	15,150	319,000
5.36	3.65	3.26	2.22	62,700	23,700	453,000
5.56	3.79	2.56	1.74	67,500	14,600	426,000
6.98	4.76	3.82	2.60	106,500	32,500	640,000

Fig. 3—Table of Results on the Loaded Pennsylvania Cars

case the weight of the car and load was known, and the acceleration was determined from the curve drawn on the drum. The speed of the drum being 15 in. per second, the velocity of the car was determined for each .01 of a second lapse of time and the difference in velocity for each .01 of a second would give the acceleration per hundredth of a second. As this was a very short space of time, the acceleration for each .01 of a second was assumed to be constant. This acceleration, as obtained from the drum, was reduced to feet per second per second and the following formula applied:

$$F = \frac{W}{g} a$$

in which F equals the force in pounds on the car, W equals the total weight of the car, g equals gravity taken as 32.2, a equals the acceleration in feet per second per second as taken from the curve drawn on the drum. There might be some question as to whether the trucks should be included in the weight of the car, but as in most cases the maximum force occurred after the car had moved approximately ¾ of an inch, it would seem that the trucks would be in motion by the time the car body had moved ¾ of an inch, so that the weight of the trucks was included in all results.

Results Obtained.—Figs. 1 and 2 give the results obtained on the light cars of the Pennsylvania and Norfolk & Western, respectively. Figs. 3 and 4 give the results obtained on the loaded cars. Column 1 of these tables gives the speed in feet per second as obtained by a stop-watch for the last 30 ft. of movement. Column 2 gives the calculated speed in miles per hour computed from the values in Column 1. Column 3 gives the maximum speed in feet per second obtained by car *B*, during the impact, this car being the first in the string of standing cars. Column 4 gives the maximum speed in miles per hour of car *B*. Column 5 gives the kinetic energy in foot-pounds of car *A* at the moment of impact. Column 6 gives the maximum

WEIGHT OF CAR "B" 248000 LBS.

VELOCITY OF CAR "A" IN FT. PER SEC.	SPEED OF CAR "A" IN M.P.H. AT IMPACT	MAXIMUM VELOCITY OF CAR "B" IN FT. PER SEC.	MAXIMUM SPEED OF CAR "B" IN M.P.H.	KINETIC ENERGY IN FOOT-POUNDS OF CAR "A"	MAXIMUM KINETIC ENERGY IN FOOT-POUNDS CAR "B"	MAXIMUM PRESSURE FROM ACCELERATION CURVE.
I	II	III	IV	V	VI	VII
2.46	1.68	.59	.40	23,300	1,340	110,000
3.41	2.33	1.24	.85	44,600	5,920	353,000
3.49	2.38	1.69	1.15	46,800	11,000	263,000
4.00	2.73	1.86	1.27	61,600	13,300	436,000
4.28	2.92	1.64	1.12	70,600	10,750	425,000
4.42	3.01	1.94	1.32	75,000	14,500	452,000
4.69	3.19	1.69	1.15	84,600	10,950	507,000
4.76	3.25	1.80	1.23	87,200	12,450	530,000
5.17	3.52	2.25	1.53	103,000	19,500	612,000
5.55	3.78	2.40	1.64	116,500	22,100	702,000
5.65	3.85	2.65	1.81	122,500	27,000	655,000
	CAR EQUIPPED WITH BUMPER BLOCKS					
3.66	2.50	1.82	1.20	51,600	13,600	389,000
3.70	2.52	1.80	1.23	52,500	12,450	398,000
3.89	2.65	1.96	1.34	58,100	14,830	359,000
4.28	2.92	2.15	1.46	70,500	17,300	500,000
4.62	3.15	2.61	1.77	82,000	26,200	487,500

Fig. 4—Table of Results on the Loaded Norfolk & Western Cars

kinetic energy in car *B* during the impact. This last value is obtained from the velocity curves recorded on the chronograph. Column 7 gives the maximum force in pounds as obtained from the maximum acceleration of car *B* during the impact. Fig. 5 shows the maximum force between the cars plotted against the speed in miles per hour of the moving car at the time of impact. That is, the results shown in Column 7 are plotted against those shown in Column 2 of each table. Fig. 6 shows the relation between the weight of the car and the maximum force in impact for speed of two, three and four miles per hour. The values here plotted were taken from the curve in Fig. 5. That is, the pressure at two miles per hour was taken off for each curve in Fig. 5 and likewise for speeds of three and four miles. By an examination of Fig. 5 it is apparent that the maximum force of impact is not directly proportional to the speed, as the curves that represent the average relation in all cases curve up as the speed of the moving car is increased. This, no doubt, is due to the fact that the kinetic energy of the moving car varies with the square of the velocity, and the force of impact would, no doubt, be also proportional to the square of the velocity if the end of each car was of sufficient strength to withstand the force without destroying it partly,

but as the force increases, some of the kinetic energy is used up in the destruction of the coupler, draft-gear connection and end-sill connection, from the horn of the coupler coming in contact with the end sills and other giving of the part. Of course, the draft gear absorbs some at each impact, but this is a constant after the draft gear once goes solid. The loss in each impact is well shown by a comparison of Columns 5 and 6, Column 5 giving the kinetic energy in the moving car and Column 6 the maximum kinetic energy in the first car. That is, the value in Column 6 would also represent the energy retained by the moving car, *A*, and by double the values in Column 6, and subtracting them from Column 5 the loss of kinetic energy for any impact can

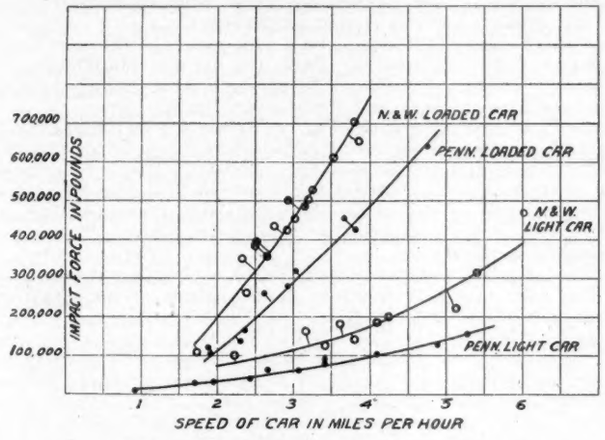


Fig. 5.—Values of Impact for Different Speeds

be determined. This loss in some cases amounts to as much as 70,000 foot-pounds of energy in one test on N. & W. cars. This can only be accounted for by the destruction of some part of the car. During the testing on the N. & W. cars a few impacts were made with the loaded cars that had bumper blocks on the ends of the car. The results are given at the bottom of Fig. 4. It will be seen that a larger per cent of the kinetic energy is transmitted to car *B* when the bumper blocks are on, and also the force between the cars is usually somewhat greater. The five points with a cross in the circle in Fig. 5 show the results on the N. & W. loaded cars equipped with bumper blocks. It will be seen that, with the exception of one point, all fall

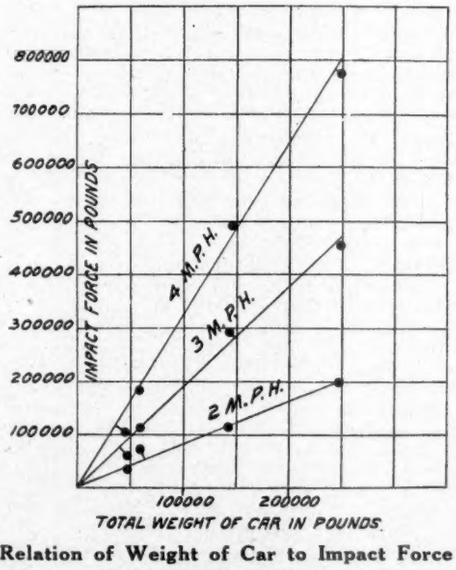


Fig. 6.—Relation of Weight of Car to Impact Force at 2, 3, and 4 M. P. H.

above the average curve. This is, no doubt, accounted for by the fact that the load is distributed over three points and thus a greater force was produced with less destruction than when the couplers and draft-gear connection received all the load. From a study of the value shown in Fig. 6, it will be seen that the maximum force of impact for any given speed is almost directly proportional to the weight of the cars in impact.

An interesting thing, which was plainly shown from the curves made on the chronograph, was the fact that the maximum force on car *B* occurred always before it had moved 1 in. Car *B* usually moved from 4 to 12 in. That is, the maximum force on car *B* occurred before any appreciable force was exerted between cars *B* and *C*, and the speed of car *B* was very slow before cars *C* and *D* had any pressure between them and car *B* was always stopped before the impact between cars *D* and *E* occurred. That is, the largest per cent of kinetic energy is taken out of the moving car in the impact between cars *A* and *B*, and the greatest damage would be done at this point. So as this force occurred before car *B* had moved 1 in., the damage to the end of the car would be just as great if only one car was standing as if a dozen were backing it up, provided there was at least 1 in. slack between the first and second cars of the standing ones. Of course, so far as the damage to the center sills at the center of the car, no doubt this damage would be greater if the cars were backed up by other cars. But these results given in this paper seem to indicate that there would be just as great a force between the cars if one car struck another car or struck a string of cars.

I wish to express my appreciation for the coöperation and assistance rendered in this work by the following men: Messrs. D. F. Crawford and T. R. Cook, of the Pennsylvania Lines West; W. H. Lewis, J. A. Pilcher and H. W. Coddington, of the Norfolk & Western R. R., and W. E. Larsen and C. O. Henry, senior students of the University of Pittsburgh.

DISCUSSION.

W. E. Symons: I would suggest the advisability of a more extended work of this character by Prof. Endsley and others who may be incorporated with him, and that the scope of the work not only be extended, but that such persons co-operate with the draft gear committee. It has been stated on excellent authority that 58 per cent to 60 per cent of our expenses of repairs to freight cars are due to buffing shocks which the draft gear did not absorb. This emphasizes the necessity of work in the direction of improving draft gear or minimizing the effect of the buffing shocks. It might also be emphasized that our freight equipment as a whole, representing an investment of possibly $1,800,000,000, is only in revenue earning service, or it only covers a productive period of about 25 per cent of its time, and possibly less, there being an unproductive period of at least 75 per cent. This fact also emphasizes the necessity of further research work and should be brought to the attention of the management of our railways to impress them with the importance of co-operating with the mechanical officers.

S. G. Thomson (P. & R.): We made a very interesting test that verifies Prof. Endsley's conclusions in regard to the standing car. We took two loaded coal cars, one with a through steel center sill, and the draught arms riveted solidly to the sill; the other one with a steel draft arm lipped tight over the bolster, making a very solid connection with the bolster. We took one car up the incline and left the other standing by itself. Both of them were wooden cars, loaded to about 60,000 lb. There was at least 2½ in. or 3 in. movement of the sills under the car. The through center sill construction gave a very perceptible movement. After the test was over we found it had cut practically every piece of flooring straight through the car. If you are going to the through sill in reinforcing cars, it is very important to tie that through sill to your bolster. If you do not do so you will probably do more damage to your car than if you had no reinforcement at all. Another conclusion that we rather drew from those tests is that, the weaker the draft gear, the less damage to the car. That sounds rather funny, but the weaker gear causes the whole car to absorb the shock and you don't get any tearing action. I think that the draft gear committee and the car construction committee ought to be given more study to the relation between the draft gear and the car construction.

C. E. Fuller: May I ask Mr. Thomson if this car had wooden end sills. You have just said the two center sills were reinforced. Were the two center sills fastened in any other way than than bolted to the wooden center sills?

S. G. Thomson: It was a through girder beam put between wooden center sills, and the draft members came right up solidly and were bolted to the cross bolster, making a fairly solid construction with the bolster, but the fact was that it was not lipped over the bolster. You could not make that construction quite solid enough without lipping over the bolster, which was a metal bolster.

Mr. Fuller: Was it riveted to the bolster?

Mr. Thomson: Yes, sir. The first shock sheared the rivets off and punched the bolts off. These were two 60,000 lb. cars, and the speed I think ranged between 8, 14 and 20 m. p. h. I think we took the cars each way and turned them around, and tried the other ends of the cars, and by the time we were through we had entirely practically

wrecked both cars, but we had gotten a great deal of information from it.

T. H. Goodnow: I would like to ask Professor Endsley if in slack tests, the cars were specially prepared for it? That is, was everything tightened up so that you would only have such slack as would exist in new construction. Taking cars as they ordinarily run, in 75 and 80 car trains, taking two engines, and bunching them, and stretching them, and then going through the same procedure again, we found that there was an average slack per car of 7 in. to 10 in. In the second test, if I remember right, of the 80 car train it ran anywhere from ten to twelve feet more than on the first test. With a train of cars that had just come from the shops that had had steel underframes applied to them, the average was only 2¾ in. to the car, or less than the total travel of both of your draft gears.

Prof. Endsley: I would say that the Norfolk & Western cars were under a year old, had been in service, and had shown that they had done some service, but everything was in good shape on the cars. The cars were pushed in so that any extra slack was not present. The Pennsylvania cars were also new cars, under two years old, but had seen some service, and had a travel of the draft gear before the horn struck of 2⅛ in. on one car and 2⅜ in. on the other. These were both solidly constructed cars, they were not wooden cars, and any comparison you make with the wooden car will be entirely different. On the Pennsylvania this work was done on cars of over 100,000 lb. capacity, weighing 48,800 lb. and having pressed center sills running entirely through. The N. & W. also had a continuous sill running through the car. They were pretty solidly constructed cars. Some of the couplers on the N. & W. cars have shanks that have been shortened up an inch in service. Now, it takes 800,000 lb. in a static machine to shorten the shank on the coupler one inch, this load to be applied in 35 seconds, running from 600,000 up, and back again.

Also some men have said to me here at this Convention that we could not take 800,000 lb. on these couplers. I had a 1,000,000 lb. on a static machine on four different couplers, that after releasing the load, you can open the knuckles with your hand, and take out the locks. These couplers will stand 1,00,000 lb. a good many times under impact. It will take some 50 blows of 800,000 lb. to shorten the shank up an inch

J. J. Tatum (B. & O.): When our presidents ask us "Why do you build cars that are so heavy? Why do you need this standard coupler you are speaking of, that is going to increase the cars in weight and cost? Why does the Committee on standard cars build the underframe so heavy? Why is it that our frictional draft gear does not hold up, that you recommend it would do better than the spring gear?" We can give them the answer to all of these questions right from this paper.

J. J. Hennessey (C. M. & St. P.): Regarding this shortening of one inch in the length of the coupler—did it take place in the horn of the coupler, or at the extreme end of the shank?

Prof. Endsley: In the shank from the head to the end of the coupler, without bending.

D. F. Crawford (Penn. Lines): In 1903 or 1904 we made some tests by dropping a car and a dynamometer car down grade of about 3 per cent against a string of standing cars. The speed was regulated by the distance that we allowed the cars to run down grade, and at that time it was found that the shock recorded by the dynamometer car was about 100,000 lb. per mile per hour up to 6 m. p. h., when the entire capacity of the dynamometer car, which was some 615,000 lb., was absorbed. Since making that experiment we have assumed that our cars must be prepared to stand an end shock of at least 250,000 lb. with comparatively small stresses. The cars that Prof. Endsley used on the Pennsylvania, and I know also on the N. & W., are cars of complete steel construction. It is not a question of underframes at all, but the entire car was of steel.

C. D. Young (Penn.): We have had in our department a large amount of experience in the recording of shocks of trains in service, and basing my views on what I have seen recorded as shocks and the resultant damage, it would seem to indicate to me that the impact force in pounds shown here is much higher than the true impact force that the material receives. Judging from these figures, it seems to me that they must be taken with some reserve. Of course, if you figure the fibre stress of center sill construction, figure the strength of the coupler in buffing under the drop or the pulling test of the coupler, and noting that the cars are struck very frequently at such a speed as 45 m. p. h. you would expect a much higher renewal rate than we actually get with these cars in service. It is possible, however, that there are some combinations of the service strains, as compared with the recorded data here, that do not make the figures comparable. It is interesting to note that the trend of the lines of the loaded cars toward a low speed of ⅛ m. p. h. or ¼ m. p. h. are not in the same direction—apparently they are crossing each other, and the loaded car at the low speed of one mile an hour receives less shock than an empty car at the same speed. That would hardly seem to be true, because the shock must be in some proportion to the mass.

Mr. Hennessey: I would ask Professor Endsley at what load the shank of the coupler commenced to compress or shorten up.

L. E. Endsley: The way the test was made, if you stop several times, you will get the coupler shortened by probably two inches. It took its first big move at about 450,000 lb.

Mr. Hennessey: Was that permanent?

Prof. Endsley: It would be permanent. In the case of the shank of the coupler to which we applied 800,000 lb., the coupler would go back .11 of an inch, that being the limit of elasticity in the metal due to its length.

R. L. Kleine (Penn. Lines): The tests which Prof. Endsley made were tests of distortion, leading to destruction. When you shorten a coupler up two inches, the coupler is destroyed. As previously stated in the coupler report, we are working within an elastic limit of material, not only in a compressive stress, but also in the pulling stress, as well as in shock.

Prof. Endsley: Of course, the time of applying the load will affect the total movement or total amount of distortion. It will take some 40 or 50 blows, instantaneous blows, of a drop hammer, of a duration of 1/300 of a second, to equal the same distortion you would get in a static machine in 35 seconds, but the total distortions, the distortions between a static load and a drop test load would be comparable if you could keep the load on any static a given time, and keep the drop test on a given equivalent time. As regards what Mr. Young says, do not imagine you get this load very often in service, because if you do, you are repairing cars. I was in a Pennsylvania yard and I was never able to measure over 3.5 to 4 miles an hour with their light cars, and many cars are switched at less than 2 miles an hour.

Mr. Kleine: Has Prof. Endsley made any tests to find out when permanent set first took place? I have taken the test figures Prof. Endsley furnished on the drop test, and also the figures that he obtained on the pulling test machine, and I might say that the permanent set is not comparable. The *C* dimension, for example, on the pulling test machine ran .02 of an inch at a load of 580,000 lb., and on the drop machine it ran .015 of an inch. There is a wide variation there.

Prof. Endsley: In answer to Mr. Kleine's statement regardings the *C* dimension I will explain that is the measurement from the nose of the knuckle to the head of the coupler. That dimension depends on a great many things, and I would not want it to be said that that was less than 0.1 in. every time, because that is a relation between the set of the knuckle, and not a distortion of metal. If it is pulling the nose out, your lock may be in one position one time and in another position another time. The comparison Mr. Kleine just made is not comparable. I grant in any individual test that the *C* dimension from the nose to the back of the coupler will vary in one direction or the other. If you will look at the report of the Coupler Committee, you will find that the line jumped back and forward, and is not comparable. In service it is an important dimension, but it is not indicated in the report as to whether it could stand overstrain or not, it merely tells us where the lock is, or how much dirt is behind the knuckle.

S. G. Thomson (P. & R.): I think the bug in the whole thing is the way you hold the object you are going to hit. Mr. Young's remarks that we ought to take with some reserve the strains we are getting in the draft gear, are pretty well taken. If we put the coupler up against a block of granite and then deliver such a blow as that, it would smash it all to pieces the first time. That is what we tried to develop in the test I spoke of before. The coupler and the draft gear and the sills themselves are all very flexible. I doubt very much whether you can deliver a blow to a coupler or more than 500,000 lb. on a car. I do not think you can hold it solidly enough to do it. The coupler will take part of the blow. It all depends on the way, it is rigged up. If the rigging is so arranged that the butt of the coupler hits the bolster at the same time the horn hits the end sill, that is one condition in the coupler; if the rigging is arranged so you have a rigid and stiff draft gear that takes all the force, and the end sill does not get any of it, you will get another condition, but if the rigging is very light and weak, the less damage to the car and the horn takes all the force, and the steel car or wooden car takes the bumps. Mr. Crawford said his tests showed 100,000 lb. per mile. If that holds out in the test we made, running the car down a hill at 20 m. p. h., there is a force of 2,000,000 lb. This

test did not do much damage. But you can see if it was not a flexible and yielding attachment, that it would be like running up against a block of granite, and it would smash everything to pieces the first crack.

Prof. Endsley: The point made by Mr. Thomson is true, that the efficiency on the start is going to determine the final pressure you have, which will control the measurements. There is no doubt about that, but what I was talking about is a solidly constructed steel car, the car we are eventually going to use. Any comparisons made some years ago of different kinds of cars would not be comparable with these.

Prof. Endsley: As I stated in my paper there was lost in some impacts 70,000 ft. lb. of work. We have draft gears on the market that will absorb 14,000 lb. In one impact on the N. & W., to show what damage can be done at 6.6 m. p. h. with a car light, nine journal boxes were broken, 5 on the standing car and 4 on the moving car.

James Coleman: Regarding the cars with which the experiments were made on the N. & W. and on the Pennsylvania, were they equipped with spring tension draft rigging, or friction draft rigging?

Prof. Endsley: On the Pennsylvania cars they were equipped with the Westinghouse gears and on the N. & W. they were equipped with the Session gears.

Mr. Barnum: I would like to amend my motion and add to it that a committee be appointed, with Prof. Endsley as Chairman, to pursue this investigation further.

Mr. Thomson: I believe the force of inertia is sufficient to do a great deal toward this permanent set, and as I said before, the blow that you can strike in holding a car loosely and the most rigid steel car that we can build, is not sufficient to strain the metal in the coupler possibly beyond 400,000 or 500,000 lb., as you cannot hold it solidly enough. I would like the Committee to determine how large a part inertia plays in this matter.

The President: I wish to make one statement—Mr. Thomson quoted my reference to 100,000 lb. per mile per hour. My knowledge of the subject quits at 6 miles per hour, and I cannot say whether he is correct in going above that figure.

(Mr. Barnum's motion as amended was carried.)

AIR BRAKE MAINTENANCE

F. W. Brazier (N. Y. C.): The maintenance of air brakes in first class serviceable condition has always been considered necessary in both passenger and freight service, but investigations of existing freight brake conditions show that they are far from satisfactory. On a 100-car freight train where a brake pipe leakage in excess of 2 lb. per minute exists, it will be found difficult to maintain through the whole brake pipe the uniform pressure necessary to produce uniform rate of deceleration for each car in the train during a brake application; yet such uniform rate of deceleration is required to control properly the motion of the train; hence, in the interest of safe and satisfactory train handling, and in the interest of economy both in time and in the quantity of air used, brake pipe leakage should be reduced to a minimum. The saving in fuel to be effected, as will appear from what follows, and to some extent the saving in wear in air brake hose, and on air compressors and locomotive boilers, should urge us to eliminate this leakage to the fullest extent possible.

Modern freight trains have become so long and the cars composing them so heavy that only the largest compressors are capable of supplying the air required to charge the brake apparatus in reasonable time. From numerous tests it has been shown that the most efficient air brake compressors consume approximately one pound of coal and require 7 lb. of steam for each 35 cu. ft. of free air compressed. The total volume to be charged for a 100 car freight train, all 10 in. brake equipment, is close to 180 cu. ft. A leakage of 4 lb. per minute from this volume—not an unusual amount met with at present in general service—means a loss of 48 cu. ft. of free air each minute, or 2880 cu. ft. each hour. Putting this in terms of coal and water it means an hourly waste of 82 lb. of coal and of 574 lb. of water, but added to this should be the wear on the locomotive boiler in producing the additional steam, and other air brake appurtenances. While 4 lb. leakage per minute has been used above for illustration, in a great many cases it will be found to be 5 or 6 lb., and in some cases it is so high that to apply the brakes all that is necessary is to lap the handle of the brake valve. The loss in coal will of course be directly proportional to the leakage in pounds. A conservative estimate of the coal consumed by the air compressor in supplying air for the average leakage in a 100 car train for 10 hours is from 860 to 1720 lb. It is worthy of note that on many freight trains about as much air is pumped through the system to supply leakage every five minutes as is required to make a full service application of the brakes.

From the foregoing it may be seen that it will cost us no more, if as much, to maintain our freight air brake apparatus practically tight, than it does to allow it to run in the present leaking condition. The cost of allowing the defects in the air system is probably not less than $1.50 for each 10 hours a 100 car train is in operation. In many cases it is much more. Other things, however, as well as a tight brake system require attention in order that the brake condition may be entirely satisfactory, and it will be necessary only to mention them, for the evil effects of continuing them in service and the remedies required to remove the objectionable features are obvious. They are: Excessive piston travel; safety chains missing; brake beam hangers and brake beams worn too thin; holes in brake levers worn oblong; interference of brake pistons with car timbers and beams; corroded brake pipes; angle cocks at improper angles, and handles missing; broken and leaky pressure retaining pipes; missing bolts and cotter keys; missing brake shoes, etc.

In connection with this subject it may be well to suggest that if the standard location of the angle cock back of the pulling face of the coupler was made 10 in. instead of 13 in., heavy strain on and pulling apart of those couplings in many cases would be avoided and also heavy leakage in those couplings. Once the freight air brake conditions are made satisfactory they can be maintained that way with very little additional labor over what is being expended at present in freight brake maintenance; while the economy effected, the improved brake operation resulting, and the freedom from accidents chargeable to air brakes that will follow the realization of the improved conditions leaves no reasonable excuse for the railroads of this country not acting as a unit to bring it about.

D. R. MacBain (N. Y. C.): It is a fact that we are having a great deal of trouble around the country on account of defective air brake equipment. One of the biggest troubles we are having is the air pipe matter.

W. O. Moody (Ill. Cent.): The elimination of leakage is largely the result of facilities at hand to discover the leaks before the engine is put on the train, and we have spent a considerable sum of money the past year in providing air plants so that we can determine the condition of the brakes before the road engine is put on; and wherever such installation has been made, very gratifying results have followed. A great many good roads are laboring under antique methods of testing triple valves; they have no improved facilities; time and money is spent to make tests that really do not amount to anything, and I think the matter of having proper facilities for testing triple valves is something which also should have attention. Various roads have air brake defect cards and have made efforts to put them in service. I should say on the whole the success of the efforts have been rather indifferent. If we could get train men to card the defects when they are observed, the inspectors would know what the trouble is and go right to that car and apply the necessary repairs, but it seems almost impossible to get that card in proper use.

J. J. Tatum (B. & O): When the cars come on the shop track the levers should be checked to know that the proper lever is maintained on the truck as required by the braking power allowed the car.

ELECTION OF OFFICERS

The following officers were elected: President, D. R. MacBain, superintendent motive power and rolling stock, New York Central Lines West of Buffalo; first vice-president, R. W. Burnett; second vice-president, C. E. Chambers, superintendent motive power, Central Railroad of New Jersey; third vice-president, J. W. Demarest, superintendent motive power, Pennsylvania Lines West of Pittsburgh, Northwest System; treasurer, J. S. Lentz, master car builder, Lehigh Valley.

The following were elected members of the executive committee: C. E. Fuller, superintendent motive power and machinery, Union Pacific; F. F. Gaines, superintendent motive power, Central of Georgia; I. S. Downing, general master car builder, Cleveland, Chicago, Cincinnati & St. Louis.

The election of members for the nominating committee resulted in the selection of F. W. Brazier, superintendent rolling stock, New York Central Lines; J. J. Hennessey, master car builder, Chicago, Milwaukee & St. Paul; F. H. Clark, general superintendent motive power, Baltimore & Ohio; F. F. Gaines, superintendent motive power, Central of Georgia; and A. W. Gibbs, chief mechanical engineer, Pennsylvania Railroad.

W. M. Garstang, T. H. Orchard, J. E. Buker, E. W. Grieves and S. A. Crone were elected life members. Prof. L. W. Wallace was elected an associate member.

LOST

Lady's handbag containing watch with the initials L. K. D. and small amount of money. Please report or return to *Railway Age Gazette* office if found.

SIXTH DAY'S REGISTRATION FIGURES

The registration figures from the sixth enrollment book for the last four conventions are given in the following table. The figures for 1911 are not available, because there were only five enrollment books issued during that convention:

	1912	1913	1914	1915
Members M. C. B. and M. M.	668	700	758	731
Special Guests	684	724	612	541
Railroad Ladies	471	521	467	421
Supply Ladies	223	312	288	235
Supply Men	1523	1680	1497	1254
Total	3569	3937	3622	3182

A. B. APPLER—AN APPRECIATION

Evidently A. B. Appler, mechanical engineer of the Delaware & Hudson, occasionally finds it necessary to discuss matters of design with the Schenectady boys. At least we infer this from the following poem which was picked up on the Boardwalk:

Little Benny Appler is an energetic man,
He comes up to Schenectady just every time he can,
He talks each subject over from every point of view,
It's up to us to cover same in "notes of interview."

There are encyclopedias on which there are no flies,
And Noah Webster's Unabridged is quite a decent size,
But all these pond'rous volumes their "rep." for size would lose,
Should some syndicate but publish these "notes of interviews."

THE NEW VICE-PRESIDENT

At the closing session of the convention yesterday Thomas W. Demarest, superintendent of motive power of the Northwest System of the Pennsylvania Lines west of Pittsburgh, was elected a vice-president of the association. Mr. Demarest was born at Englewood, N. J., March 18, 1868, and was graduated from Stevens Institute of Technology in 1888. He entered railway service as a special apprentice in the shops of the Pittsburgh, Cincinnati & St. Louis at Columbus, Ohio, in 1889. On August 1, 1891, he was made assistant to the superintendent of motive power of that road, and for one year, 1896, was assistant to the master mechanic in charge of shops at Indianapolis, Ind. For the next two years he was general foreman of the locomotive department at that place, and in 1899 was made master mechanic at Logansport, Ind. From January 1, 1900, to July 1, 1903, he was superintendent of motive power of the same road. He was appointed to his present position in July, 1903.

PRESENTATION TO MR. CRAWFORD

At the closing session of the Master Car Builders' Association George A. Post presented the past president's badge to the retiring president, D. F. Crawford. He said in part:

"I come from the Court of Appreciation over which no crowned potentate bears sway, creating favorites without rhyme or reason to gratify caprice, or stripping of honors those who fall under the shadow of a fitful frown. My credentials are from a world power (habitat in the hearts of men) which sits in judgment upon the activities, motives and achievements of struggling mortals, eager to pay tribute to those who prove themselves worthy of reward.

"Young as I am, Mr. Crawford, I have witnessed your novitiate in engineering science; your masterful strides toward the goal of distinction in your chosen field of strenuous endeavor during the intervening years, and today I count myself singularly fortunate that I have been designated to call out publicly the station at which you have arrived *en-tour* where you are stopping only long enough for this appropriate decoration."

Conventionalities

J. F. Walsh, formerly superintendent of motive power of the Chesapeake & Ohio, Mrs. Walsh and daughter arrived Sunday and are stopping as usual at the Chalfonte Hotel. Mr. Walsh has recently recovered from a rather serious illness.

A visit from the "stork" necessitated W. H. Coyle, vice-president of the Franklin Railway Supply Company, remaining home for the early part of the conventions. He arrived today reporting the addition of a bouncing boy to his family. This is the second boy.

William St. John, of the Safety Car Heating and Lighting Company, was unable to attend this year's convention

President-Elect S. W. Pratt, of the M. C. B. Association, and Mrs. Pratt

because of illness. His many friends have missed him; and we join with them in wishing him many happy returns of his birthday, June 18.

J. Leonard Replogle, who left for New York yesterday afternoon, was made vice-president and general manager of sales of the American Vanadium Company on March 1 last and represented that concern instead of the Cambria Steel Company of which he had been vice-president and general manager of

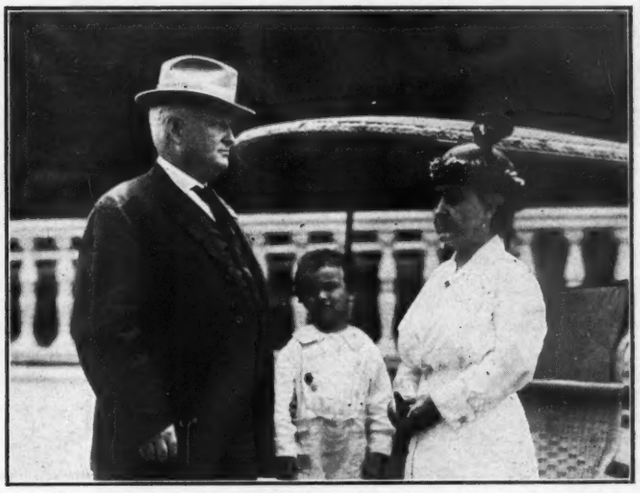
sales and with which he had been identified for more than 26 years.

Charlie Storrs, manager of the railroad department of the Storrs Mica Company, was late in getting here. His tardiness is explained by the fact that he stopped off at Ithaca to attend

Left to Right—S. W. Mullinix, Supt. Shops, C. R. I. & P.; Fred W. Venton (Crane & Co.); J. C. Campbell (Chicago Pneumatic Tool Co.), and L. A. Richardson, Mech. Supt., C. R. I. & P.

his class reunion—something that he has been compelled to miss for several years past because it occurred simultaneously with the conventions.

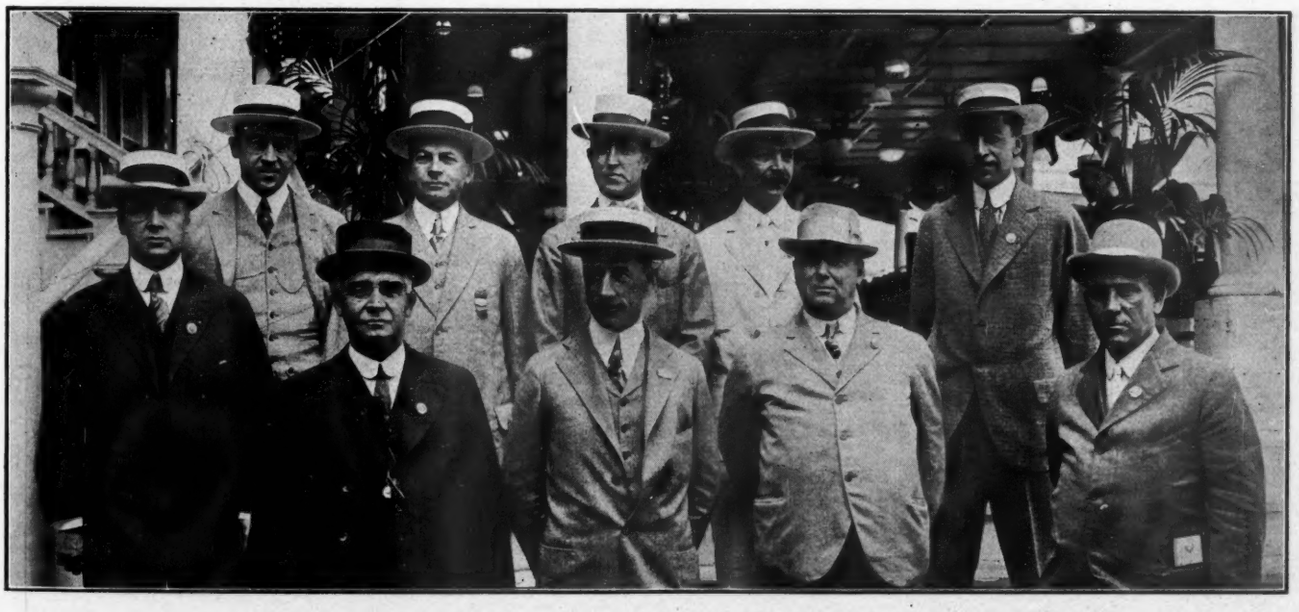
Among those whom all enjoyed seeing at the conventions in years past, but who are not here this year, is H. J. Small, formerly superintendent of motive power of the Southern Pacific, who has retired, and is now interesting himself chiefly in the progress of his sons in business. T. W. Heintzelman, general superintendent of motive power of the Southern Pacific, expected to come to attend the conventions, but owing to important matters has found it impossible to come. J. F. Graham, superintendent of motive power of the Oregon-Washington Railway & Navigation Co., has not sufficiently recovered from his recent serious illness to make the trip, but his many friends will be glad to learn that he is improving and hopes to be in evidence next year. R. W. Burnett, who recently resigned as master car builder of the Canadian Pacific, has gone to San Francisco for a long



John A. Pilcher, Mechanical Engineer, Norfolk & Western, Wife and Son, William

needed rest, and more particularly with the hope that Mrs. Burnett's health will be improved.

The neat little pencils used at all the dances in connection with the conventions, except the Friday Carnival, were presented to the entertainment committee by the Joseph Dixon Crucible Company, who furnished about twenty-five gross of them. Inasmuch as the committee did not have a large fund to draw upon the gift was much appreciated.



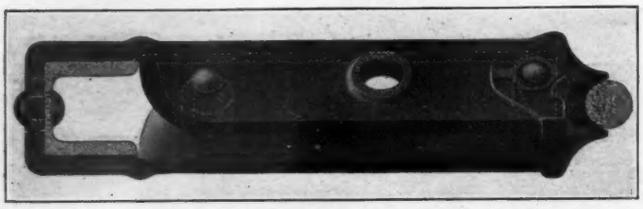
LARGELY SANTA FE OR EX-SANTA FE MEN

Top Row, Left to Right—P. M. Ripley (formerly on Santa Fe), Assistant to Vice-President, El Paso & Southwestern; Albert MacRae, Editor, Santa Fe Employees' Magazine; John P. Landreth, Garlock Packing Company, Chicago; Frank W. Thomas, Supervisor Apprentices, A. T. & S. F.; C. T. Ripley, General Mechanical Inspector, A. T. & S. F.

Bottom Row—M. H. Haig, Mechanical Engineer, A. T. & S. F.; J. H. McGoff, Mechanical Superintendent, A. T. & S. F.; W. L. Allison (Formerly Mechanical Engineer, A. T. & S. F.), Vice-President, American Arch Company; John Purcell, Assistant to Vice-President, A. T. & S. F.; J. E. McQuillen, Mechanical Superintendent, G. C. & S. F.

FORGED STEEL BRAKE BEAM STRUT

A recently developed forged steel strut for truss type brake beams is being exhibited by the Buffalo Brake Beam Company, 30 Pine Street, New York. The strut is a one-piece forging, terminating at the truss rod end in a pocketed steel casting, to the flanges of which it is securely riveted. It



Forged Strut for Brake Beams

is designed to secure greater reliability and strength than is usually possible with a casting and, as shown in the illustration, is simple of design and easy of application.

ALL-STEEL BOX CAR

At the space of the Bettendorf Company, of Bettendorf, Iowa, an all-steel box car is on exhibition which embodies a number of features of interest. The underframe and trucks are of the standard Bettendorf type of construction, all the principal dimensions being in accordance with the recommendations of the M. C. B. committee on car design.

The construction of the superstructure is generally similar to that of the Union Pacific automobile cars described in the *Railway Age Gazette, Mechanical Edition,* for February, 1915, page 73, and in the February 5 issue of the *Railway Age Gazette*. The side sheets are applied to the outside of the frame, however, while those of the Union Pacific cars were applied inside. These sheets are of ⅛ in. steel cut in panels with the vertical edges flanged at right angles to the body of the sheets. The flanges of the adjoining sheets are riveted to the web of a Z-bar post from the inside of the car, thus producing an extremely smooth exterior.

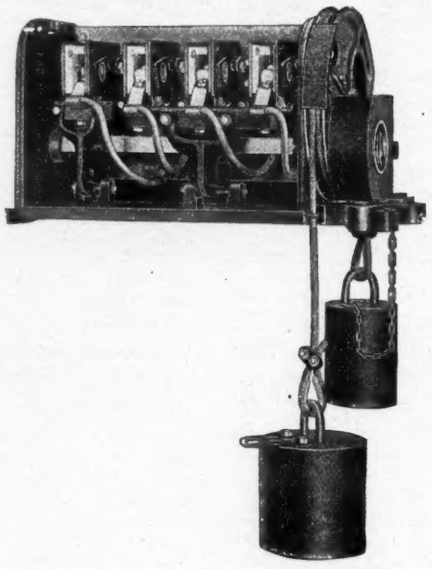
The whole car is wood lined throughout so that severe climatic conditions will not cause precipitation of moisture. The principal data and dimensions of the car are:

Capacity	100,000 lb.
Length inside	40 ft. 6 in.
Width inside	8 ft. 6 in.
Height inside	9 ft. 0 in.
Width of side door opening	6 ft. 0 in.
Weight complete with lining	45,900 lb.
Weight of trucks complete	15,000 lb.

SAFETY LIMIT STOP FOR ELECTRIC CRANES

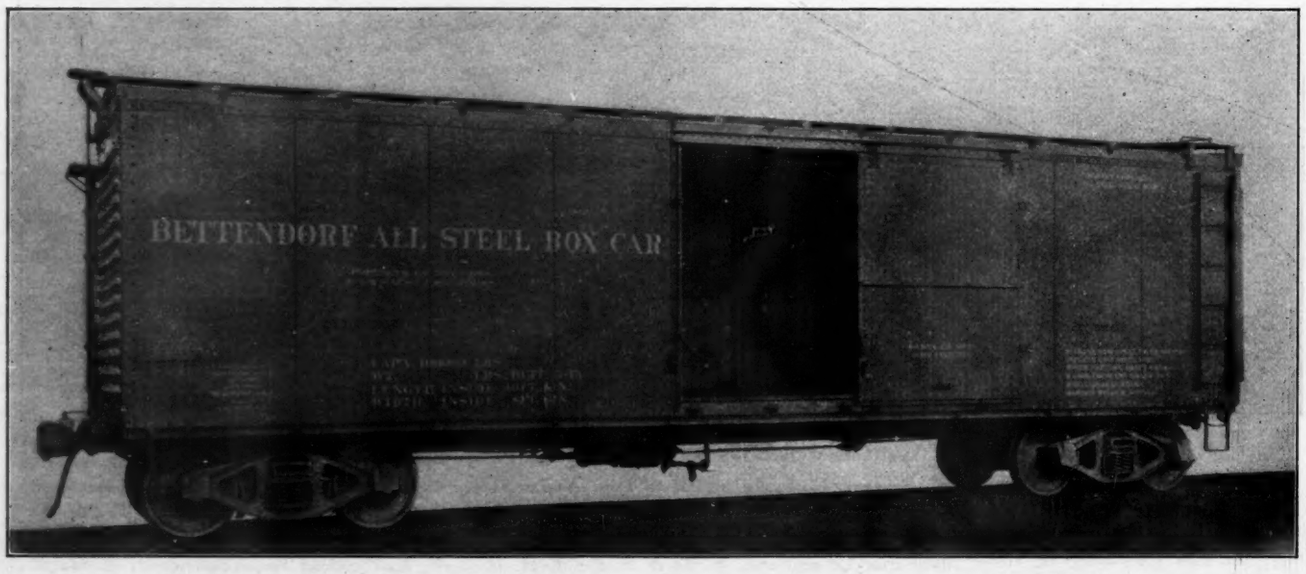
A device designed to automatically prevent over travel of crane hooks is shown in the illustration. It is being exhibited by the Electric Controller & Manufacturing Company, Cleveland, Ohio, and consists of a cast iron frame within which is a set of cam operated electric contacts which control the hoisting motor circuit. The frame is mounted on the top of the crane trolley, where it is accessible for inspection. The contacts are operated by a sheave and steel cable to the ends of which are attached weights of cast iron.

The operation is controlled by a shoulder attached to the crane hook. As the point of highest travel consistent with safety is approached this shoulder raises the lower weight,



Safety Limit Stop for Crane Hooks

and causes the sheave to rotate. The motor circuit is thus opened and a dynamic breaking circuit closed which brings the motor to rest within a hook travel of two inches, regardless of the load or the speed at which it is being hoisted. Lowering the hook permits the moving parts of the automatic stop to return to normal position without attention. The contacts are opened under the influence of a magnetic blow-out, and are protected by a sheet iron cover which may be readily removed for inspection.



Bettendorf Steel Box Car